IN THE

Supreme Court of the United States

OCTOBER TERM, 1970.

No. 338

BLONDER-TONGUE LABORATORIES, INC.,
Petitioner,

vs.

UNIVERSITY OF ILLINOIS FOUNDATION, ET AL.,
Respondents.

ON WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SEVENTH CIRCUIT.

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RELEVANT DOCKET ENTRIES.

Date	Filings—Proceedings
3/29/66	Filed complaint and 2 copies
	• • • • •
5/ 9/66	On Court's motion, cause set for report on status on June 16, 1966—Hoffman, J.
	• • • • •
5/31/66	Filed Motion to dismiss under Rule 12(b) and/ or motion for summary judgment. Defendants Brief in support of the Motion
6/10/66	Filed Plaintiff's answering brief opposing motion of defendant Blonder-Tongue Laboratories, Inc. to dismiss (To J. Hoffman)
6/16/66	Filed Motion to dismiss under the provisions of Rule 12(b) and/or Motion for Summary Judgment under the provisions of Rule 56—Defendants' Reply brief in support of motion (To J. Hoffman)
6/16/66	Leave to defendants to file instanter their reply brief in support of motion to dismiss—Hoffman, J.
	• • • • •
6/16/66	Cause to retain its place on the calendar—Hoffman, J.
	• • • • •
6/22/66	Filed Plaintiff University of Illinois Foundation's first set of interrogatories to defendant Blonder-Tongue Laboratories, Inc. under Rule 33
	• • • • •

7/ 5/66 On Courts Motion, cause placed on call of cases holding place for trial Calendar No. 88, Hoffman, J.

• • • • •

8/11/66 Filed Answers to plaintiff's interrogatories by defendant Blonder-Tongue Laboratories, Inc.

• • • • •

8/25/66 Filed Plaintiff's second set of interrogatories to defendant Blonder-Tongue

9/ 1/66 Filed defendant Blonder-Tongue Laboratories, Inc. Answer and counterclaim and Exhibit A

• • • • •

9/ 7/66 By stipulation order Allied Radio Corp. dismissed as one of the defendants herein (Draft) Will, J.

9/ 7/66 Filed Notice of motion and Motion to join JFD Electronics Corporation as a party counterclaim defendant

9/ 7/66 Enter order—Motion to join JFD Electronics Corporation as a party counterclaim defendant granted, said party counterclaim defendant to answer within 20 days—Will, J.

• • • • •

9/23/66 Filed plaintiff's reply to counterclaim of Defendant Blonder-Tongue Laboratories, Inc.

• • • • •

9/22/66 Filed Plaintiff's third set of interrogatories to defendant Blonder-Tongue Laboratories, Inc.

10/20/66 Filed Defendant's substitute answers to plaintiff's second set of interrogatories and answers to plaintiff's third set of interrogatories

11/ 1/66 Filed Counterclaim defendant's JFD Electronics Corporation, reply to counterclaim of counterclaimant, Blonder-Tongue Laboratories, Inc., and cross-claim

• • • • •

11/18/66 Filed Reply of Blonder-Tongue Laboratories, Inc. to cross-claim of JFD Electronics Corp.

1/13/67 On Court's motion, cause will be added to the trial call on February 20, 1967. Counsel required to be ready for trial

• • • • •

1/16/67 Filed Amended complaint

• • • • •

1/23/67 Filed Amended answer and counterclaim of defendant Blonder-Tongue Laboratories, Inc.

1/24/67 Filed Counterclaim defendant (JFD) Notice of prior art to be relied upon by the counterclaim defendant at the trial of this action

1/24/67 Filed Counterclaim defendant's (JFD) Supplemental notice of prior art to be relied upon by the counterclaim defendant at the trial of this action

1/30/67 Filed Counterclaim defendant's (JFD Electronics Corporation) reply to amended counterclaim of counterclaimant, and cross-claim

1/31/67 Filed Plaintiff's Reply to Amended Counterclaim of defendant and counterclaimant.

2/ 3/67 Filed Counterclaim defendant's Second Supplemental notice of prior art to be relied upon by the counterclaim defendant at the trial of this action

2/ 3/67 Filed defendant and counterclaimant's Notice of motion, motion to postpone depositions, and Affidavit in support of motion to postpone depositions (Blonder-Tongue Laboratories)

2/ 3/67 Motion of defendant and counterclaimant to postpone taking of depositions denied—Hoffman, J.

• • • • •

2/ 3/67 Filed Reply of Blonder-Tongue Laboratories, Inc. to cross-claim of JFD Electronics Corporation

2/ 7/67 Filed deposition of Isaac S. Blonder (2 volumes)

2/17/67 Filed Interrogatories of defendant, Blonder-Tongue Laboratories, Inc. to plaintiff, University of Illinois Foundation and to the University of Illinois under Rule 33

2/20/67 Cause held on trial call until May 1, 1967 at 10 A. M.—Hoffman, J.

• • • • •

3/22/67 On motion JFD Electronics Corp., counterclaim defendant, order cross-claim hereby dismissed with prejudice and without costs—Decker, J.

• • • • •

3/29/67 Filed Plaintiff's list of exhibits and witnesses

3/31/67 Filed Further additional supplemental notice of prior art to be relied upon by the counterclaim defendant at the trial of this action

3/31/67 Filed Additional supplemental notice of prior art to be relied upon by the counterclaim defendant at the trial of this action

4/17/67 Filed deposition of Blonder-Tongue Laboratories, Inc. by Richard B. Helhoski, Jerome I. Cohn, Harry Gilbert, and Robert F. Heslin (4 volumes)

• • • • •

4/27/67 Filed Deposition of Dr. Paul E. Mayes (2 volumes)

4/27/67 Filed Deposition of Hjalmar W. Johnson, Ronald D. Grant, and James C. Colvin (3 volumes)

• • • • •

5/ 1/67 Cause held on trial call until May 16, 1967 at 10 A. M.—Hoffman, J.

4/28/67 Filed Stipulation of Facts by Blonder-Tongue Laboratories, Inc. and JFD Electronics Corporation.

5/16/67 Cause held on trial call until May 23, 1967 at 10 A. M.—Hoffman, J.

5/23/67 Cause held on trial call until May 25, 1967 at 10 A. M.—Hoffman, J.

5/25/67 Cause held on trial call until May 29, 1967 at 10 A. M.—Hoffman, J.

5/26/67 Filed notice of motion and defendant Blonder-Tongue Laboratories, Inc., motion re rescheduling for trial and affidavit of Richard S. Phillips

5/29/67 Cause held on trial call until June 13, 1967 at 10 a.m. Hoffman, J.

5/26/67 Motion of defendant and counterclaimant to reset cause from May 29, 1967 to June 13, 1967, entered and continued to May 29, 1967 at 10 a.m. Hoffman, J.

5/29/67 Enter Order motion of defendant and counterclaimant to reset cause from May 29, 1967 to June 13, 1967, *allowed*. Hoffman, J.

6/ 5/67 Filed deposition of Jerome N. Balash

6/13/67 Cause held on trial call until June 16, 1967 at 10 A. M.—Hoffman, J.

6/16/67 Cause held on trial call until June 30, 1967 at 10 A. M.—Hoffman, J.

6/20/67 Filed deposition of Dr. Paul E. Mayes and Ronald D. Grant (2 volumes)

6/30/67 Cause to retain its place on calendar. Hoffman, J.

7/18/67 On Courts motion—Cause placed on call of cases holding place for trial Calendar No. 5—Hoffman, J.

8/15/67 On Court's motion, cause will be placed on the trial call on Tuesday, September 12, 1967, at 10 A. M. Counsel required to be ready for trial—Hoffman, J.

9/11/67 Filed Notice of motion and Motion for order postponing trial date

9/11/67 On motion of plaintiff Cause reset from September 12, 1967 and held on trial call until October 23, 1967 at 10 A. M.—Hoffman, J.

10/23/67 Filed Notice of Motion, Motion, and Affidavit of Richard S. Phillips

10/23/67 On motion of defendant—Cause held on trial call until December 18, 1967 at 10 A. M.—Hoffman, J.

12/18/67 Cause held on trial call until December 20, 1967 at 10 A. M.—Hoffman, J.

12/20/67 Cause held on trial call until December 26, 1967 at 10 A. M.—Hoffman, J.

12/26/67 Filed notice of motion and defendant's motion re rescheduling cause and affidavit of Richard S. Phillips

12/27/67 Filed supplemental affidavit in support of defendant-counterclaimant's motion (to continue, stay or postpone trial for 30-45 days)

12/26/67 Motion of defendant and counterclaimant that trial be rescheduled for a date no earlier than February 13, 1967, denied. Hoffman, J.

12/26/67 Cause held on trial call until December 27, 1967 at 10 a.m. Hoffman, J.

12/27/67 Motion of defendant counterclaimant to postpone trial, denied. Hoffman, J.

12/27/67 Cause continued and held for trial on December 28, 1967 at 10:a.m.—Hoffman, J.

12/28/67 Cause called for trial. Opening statements heard. Evidence heard for plaintiff. Cause continued to December 29, 1967 at 10 A.M.—Hoffman, J.

12/29/67 Further evidence heard for plaintiff. Cause continued to January 2, 1968 at 10 A.M.—Hoffman, J.

1/ 2/68 Further evidence heard for plaintiff. . . .

• • • • •

1/ 3/68 Filed Stipulation re testimony and exhibits.

1/ 3/68 Further evidence heard for defendant. . . .

• • • • •

1/ 4/68 Further rebuttal evidence heard for plaintiff.

• • • • •

1/ 5/68 Further rebuttal evidence heard for plaintiff.

• • • • •

1/ 8/68 Further rebuttal evidence heard for plaintiff.

• • • • •

1/ 9/68 Further evidence heard for defendant-counter-plaintiff re Counterclaim.

• • • • •

1/10/68 Further evidence heard for defendant-counter-plaintiff on the counterclaim—

• • • • •

1/11/68 Further evidence heard for defendant-counter-plaintiff on the counterclaim.

• • • • •

1/12/68 Filed Stipulation re copies of License Agreements.

1/12/68 Filed Stipulation re copies of correspondence between JFD Electronics, et al.

1/12/68 Filed Stipulation re defendant Blonder-Tongue Laboratories, Inc.'s Exhibit 61 and Exhibit 26.

1/12/68 Further evidence heard for the defendant and counter-plaintiff.

• • • • •

1/15/68 Evidence heard for plaintiff and counterclaim defendant.

• • • • •

1/16/68 Re-counterclaim—Further evidence heard for counterclaim-defendant J. F. D. in defense of counterclaim. Counterclaim-defendant J. F. D. rests. Further evidence heard for defendant and counter-claimant. Defendant and counter-claimant rests. All parties rest. Cause taken under advisement.

• • • • •

6/27/68 Filed Memorandum of Decision and Order.

• • • • •

7/11/68 Filed Clerk's File Copy of Transcript of Proceedings had before the Hon. Julius J. Hoffman, Judge on December 28 and 29, 1967: January 2, 3, 4, 5, 8, 9, 10, 11, 12, 15, and 16, 1968 by Official Court Reporter.

7/25/68 Filed defendant and counterclaimant Blonder-Tongue Laboratories, Inc., notice of appeal.

• • • • •

9/ 3/68 Filed original record on appeal.

• • • • •

12/11/68 Filed 10 copies of appellant's appendix, service.

• • • • •

12/17/69 Filed 4 sets of 2 vol. of exhibit exhibits, service (per 30(c)).

• • • • •

4/10/69 Heard and taken under advisement.

2/16/70 Entered judgment order (see order).

2/16/70 Opinion by Judge Fairchild.

• • • • •

2/27/70 Filed 25 copies appellee's petition for clarification, reconsider and rehearing, en banc—service.

• • • • •

4/ 2/70 Entered order amending opinion filed 2/13/70 in part; (see order denying the suggestion for rehearing en banc; and denying motion of JFD Electronics Corp for clarification of order disallowing co (illegible).

4/ 7/70 Filed orig. & 3 copies of defendant & counterclaimant appellant petition for stay of mandate —service.

4/10/70 Entered order granting motion of 4/7/70. (mandate stayed 30 days).

5/11/70 Filed orig. & 3 copies of appellant's motion for stay of mandate—affidavit and service.

5/18/70 Entered order granting motion of 5/11/70. (mandate stayed to 6/10/70).

6/ 9/70 Filed orig. & 3 copies petition for stay of mandate—service.

6/ 9/70 Entered order granting motion of 6/9/70. (stayed to 7/1/70).

6/29/70 Filed orig. & 3 copies appellant's motion to stay mandate—service.

7/ 6/70 Entered order granting motion of 6/29/70 only to July 10, 1970.

7/ 9/70 Filed notice of filing petition for writ of certiorari as #338.

10/28/70 Filed notice of order allowing certiorari.

IN THE UNITED STATES DISTRICT COURT,

For the Northern District of Illinois,

Eastern Division.

The University of Illinois Foundation, *Plaintiff*, *vs.* Blonder-Tongue Laboratories, Inc. & Allied Radio Corporation, *Defendants.*	Civil Action No. 66-C-567.

COMPLAINT.

1. Plaintiff, The University of Illinois Foundation, is a non-profit corporation organized under the laws of the State of Illinois and has its place of business at Urbana, Illinois.

2. Defendant, Blonder-Tongue Laboratories, Inc. is a corporation organized under the laws of the State of New Jersey and has its principal place of business at 9 Alling Street, Newark, New Jersey.

3. Defendant, Allied Radio Corporation, is a corporation organized under the laws of the State of Illinois and has its principal place of business at 100 North Western Avenue, Chicago, Illinois.

4. This is a suit for patent infringement, arising under the patent laws of the United States.

5. United States Letters Patent No. 3,210,767 was duly and legally issued to Plaintiff on October 5, 1965, as assignee of Dwight E. Isbell. Plaintiff is the owner of said patent and of all rights of recovery thereunder.

6. Defendants, and each of them, are infringing said Letters Patent by making or causing to be made or sold,

without license from plaintiff, radio and television antennas embodying the invention of said patent within this District and elswhere in the United States and will continue to do so unless enjoined by this Court.

Wherefore, plaintiff prays for the issuance of a judgment providing that:

1. Plaintiff is the owner of United States Letters Patent No. 3,210,767 and of all rights of recovery thereunder;

2. Said Letters Patent No. 3,210,767 is good and valid in law and has been infringed by defendants and each of them;

3. An injunction be issued enjoining defendants from further infringement of said patent permanently and during pendency of this suit;

4. An accounting be had to determine the damages to which plaintiff is entitled for such infringement and that the damages so ascertained be awarded to plaintiff, together with interest;

5. Plaintiff be granted its costs of this action and such other and further relief as may seem proper to the Court.

Merriam, Marshall, Shapiro & Klose,
By Basil P. Mann,
30 West Monroe Street,
Chicago, Illinois 60603,
Attorneys for Plaintiff.

Date:

Of Counsel:
Charles J. Merriam,
William A. Marshall,
Basil P. Mann,
Merriam, Marshall, Shapiro & Klose,
30 West Monroe Street,
Chicago, Illinois 60603.

IN THE UNITED STATES DISTRICT COURT.
(Title Omitted in Printing)

ANSWER AND COUNTERCLAIM.

Answer.

Now comes the defendant, Blonder-Tongue Laboratories, Inc. (hereinafter referred to as BT), by its attorneys, and answers the complaint herein, pursuant to this Court's order of August 12, 1966, as follows:

1, 2, 3, 4. Paragraphs 1, 2, 3 and 4 of the complaint are admitted.

5. Answering paragraph 5 of the complaint, defendant denies that United States Letters Patent No. 3,210,767 was either duly or legally issued to plaintiff, as assignee of Dwight E. Isbell, though admitting that such a patent in fact exists; and defendant is without sufficient information and belief to admit or deny the remaining allegations of this paragraph and therefore leaves plaintiff to its proof.

6. Defendant denies each and every allegation of paragraph 6 of the complaint.

Further answering, defendant states that (a) the accused antennas do not incorporate any patent invention described or properly claimed in the patent in suit and do not infringe said patent, assuming, arguendo, its validity; and (b) that said patent in suit is in fact invalid and unenforceable against defendant for the reasons set forth in the counterclaim herein.

Wherefore, defendant prays for the dismissal of the complaint and for such other and further relief in the premises as to this Court may seem just and proper.

Counterclaim.

Now comes the defendant BT, by its attorneys, and by way of counterclaim to the complaint herein, alleges as follows:

1. Counterclaimant Blonder-Tongue Laboratories, Inc. (BT) is a corporation duly organized and existing under the laws of the State of New Jersey, having a principal place of business at 9 Alling Street, Newark, New Jersey, where it manufactures and sells for distribution throughout the United States, including within the Northern District of Illinois, antennas under its trademarks Golden Dart and Golden Arrow.

2. The University of Illinois Foundation (Foundation) is a non-profit corporation organized and existing under the laws of the State of Illinois, having its place of business at 224 Illini Union, Urbana, Illinois; and, upon information and belief, said Foundation is wholly owned and controlled by the University of Illinois of Urbana, Illinois, being an alter ego of said University, which, in turn, is a public institution supported principally by funds derived from the State of Illinois, the United States Government and other public sources and exempted from taxation upon the representation that it is a non-profit educational institution.

3. JFD Electronics Corporation (JFD), upon information and belief, is a corporation organized under the laws of the State of New York, having places of business and doing business at 6330 West Hermione Street and at 6139 West Touhy Avenue, Chicago, Illinois, where, and elsewhere within the Northern District of Illinois, it has engaged jointly with the said Foundation, and severally, in acts of unfair competition and other actionable causes hereinafter set forth.

Count I—For Unfair Competition.

4. This cause of action arises by virtue of diversity of citizenship and an amount in controversy exceeding ten thousand dollars, exclusive of interest and costs, and under the unfair competition and related laws of the State of Illinois and under 28 U. S. C. 1338.

5. On information and belief, the plaintiff and counterclaim defendant, said Foundation, after acquiring rights under certain so-called log-periodic antenna designs, including title to Isbell Patent No. 3,210,767, the subject matter of the complaint herein, entered into a commercial business arrangement, including a license agreement, with counterclaim defendant JFD to exploit the said antenna designs and patent in the field of receiving antennas for television and FM broadcast, under the terms of which the antennas for said field would be exclusively manufactured and sold by JFD and distributed by JFD from its place of business in Chicago, Illinois and elsewhere, and moneys received therefrom would be divided between JFD and the Foundation in accordance with certain percentage figures.

6. Further in accordance with said commercial business arrangement, on information and belief, the Foundation undertook the primary responsibility of policing said patent and of aiding the commercial sales of the antennas of JFD, in which, as before stated, it shared in the sales returns, by news releases and other advertising media using the name of said Foundation and threatening all manufacturers in the industry (and thus counterclaimant BT) with suit if any so-called log-periodic antennas were made and sold by them, and by announcements and mailings to customers of such other manufacturers, including customers of BT, of suits which were filed and intended suits, regardless of whether such antennas were actually covered by said patent or any other patent of the Foundation or JFD.

7. On information and belief, said Foundation and JFD conspired unlawfully to restrain competition in the field of television and FM broadcast receiving antennas, and jointly and severally have engaged in unlawfully restraining such competition by at least the following acts and possibly others, presently unknown to counterclaimant, but as to which counterclaimant prays leave to add by amendment to this counterclaim upon completion of discovery herein:

(a) Publication of copious advertisements in national, technical and popular publications and elsewhere, circulated throughout the United States, including the Northern District of Illinois, using the names of both said Foundation and JFD, knowingly and falsely representing the scope of their patent coverage as embracing all antennas of the so-called log-periodic type, and generally threatening every antenna manufacturer (which includes counterclaimant BT) and customers in said field with patent suit even before the issuance of said Patent No. 3,210,767, illegally to restrain competition in the manufacture and sale of all log-periodic type antennas, including those clearly outside such patent coverage.

(b) Conspiring to use and using the name and prestige of the supposedly non-profit tax-free educational and research institution, said Foundation, in falsely representing to the public, in newspapers, sales catalogs and magazine advertisements, within the Northern District of Illinois and throughout the country, that only said JFD had a right to make log-periodic antennas, and that only the antennas of JFD had certain desirable performance characteristics, thereby illegally influencing the public, through the prestige of said Foundation, to patronize only the defendant JFD.

(c) Conspiring to join and joining forces in a nationwide advertising campaign and otherwise misusing the name, influence, reputation and prestige of said Foundation and the tax-exempt University of Illinois in a crass

commercial activity dedicated to the restraint of competition by such false and misleading statements above set forth, and by falsely libeling and disparaging competitors' businesses and antenna products, including those of counterclaim BT, by maliciously misleading statements that none of such competitors could use the log-periodic principle or get the allegedly desirable performance attainable therewith.

(d) Committing the acts aforesaid to create and perpetuate a reluctance in the trade and among prospective customers to purchase antennas from counterclaimant, and to create an unjustified concern that counterclaimant would not be able to continue to supply their antennas and that purchasers would subject themselves to the risk of incurring expense and inconvenience and of impairment of business reputation by being sued for patent infringement by said Foundation.

(e) Conspiring to sue and suing counterclaimant BT (and other manufacturers) under said Patent No. 3,210,767, in the United States District Court for the Northern District of Illinois, Eastern Division, in a suit wherein the complaint on its face shows that said Foundation knew it had no jurisdiction over counterclaimant BT, but with the clear purpose of providing an excuse for each of said Foundation and JFD, within a few days after the filing of said complaint, to issue separate and independent news releases announcing suit against the counterclaimant BT, by name, and thereupon circularizing copies of said news releases to many customers of counterclaimant BT, both within the Northern District of Illinois and throughout the country, illegally to mislead said customers into thinking that counterclaimant BT had been properly sued and illegally to induce said customers to cease buying from counterclaimant and to purchase only from JFD.

(f) Conspiring to perform and performing the acts set

forth in (a) through (e) above, while, on information and belief, knowing that BT, even before the issuance of said Patent No. 3,210,767, had been marketing its antennas marked "patent pending" and that such antennas were not infringements of said patent No. 3,210,767, wherefore neither the Foundation nor JFD even bothered, prior to instituting suit, to send any formal notice of infringement to counterclaimant or formally to discuss the same with it.

(g) Conspiring further to mislead the public by deliberately changing the electrical and mechanical design of many of the JFD antennas over to the design of BT's own antennas, and thereafter falsely representing to the public that these changed designs were actually those of the Foundation and JFD and were covered by the said Foundation patent, thus libeling the rights and title of BT in and to its own antennas.

(h) Representing and publishing in advertising, sales literature and instructional material accompanying the JFD antennas and under the names of both said Foundation and JFD, that said antennas operate according to a patented log-periodic formula; whereas in actual fact said antennas were not then patented, were not log-periodic, did not operate according to the so-called log-periodic formula, and such formula as such was not patented—all facts then well-known to said Foundation and JFD but which, on information and belief, they deliberately chose to disregard in their intent to mislead and deceive the public, not only in unfair competition with counterclaimant, but in violation of the false patent marking provisions of 35 U. S. C. 292, as well.

(i) Damaging the business of counterclaimant by loss of sales and good will among its customers and potential customers and by the resulting diminution of the position and value of counterclaimant BT's own patented antennas;

(j) And, as part of the campaign unfairly to compete

with counterclaimant and to try to restrain it from becoming established as a serious antenna competitor of JFD, deliberately inducing the manager and organizer of BT's complete antenna business recently to leave the employ of BT and to enter the employ of JFD, knowing that such manager was the sole and key executive in BT's antenna business and that his loss would greatly impair BT's ability to maintain continuity in the development of its antenna business.

Count II—Anti-Trust.

8. This count arises under the anti-trust laws of the United States, including the Sherman and Clayton Acts, as amended.

9. Counterclaimant reasserts the allegations of paragraphs 1-7 of this counterclaim, the acts complained of therein constituting clear violations of the anti-trust laws of the United States, as well, particularly in view of the fact that said JFD is one of the largest manufacturers of antennas for said field in the United States.

Count III—Patent Infringement.

10. This count arises under the patent laws of the United States.

11. Counterclaimant reasserts the allegations of paragraphs 1-9 of this counterclaim.

12. Counterclaimant BT is the owner of United States Letters Patent No. 3,259,904 "Antenna Having Combined Support and Lead-In" which duly and legally issued on July 5, 1966, and a copy of which is annexed hereto as Exhibit A.

13. The patent, Exhibit A, covers the Golden Dart and Golden Arrow antennas manufactured by BT and which said Foundation charged infringe the Isbell Patent No.

3,210,767, the subject matter of the complaint in this litigation.

14. As set forth in paragraph 7(g) hereof, JFD and the Foundation changed the design of certain of their antennas to copy the invention covered by the BT patent, Exhibit A, including the JFD models LPB-VU18, 15, 12, 9 and 6, LPV-TV 19, 16, 13 and 10, and possibly others presently unknown to counterclaimant, and, since the issuance of counterclaimant's patent, and within six years of the filing of this count, have been inducing the public, within the Northern District of Illinois and elsewhere in the United States, to purchase said certain antennas including said Models manufactured by JFD in clear infringement of the rights covered by said BT patent, Exhibit A; and JFD and the Foundation, pursuant to their commercial business arrangement set forth in paragraphs 5-7 hereof, are offering for sale, stocking, distributing and selling, within the Northern District of Illinois and elsewhere in the United States, antennas including said Models above, that embody the invention of and infringe said BT patent, Exhibit A, and will continue so to do unless enjoined by this Court.

Count IV—Declaratory Judgment for Patent Invalidity and/or Non-Infringement of Patent No. 3,210,767.

15. Counterclaimant reasserts the allegations of paragraphs 1-14 of this counterclaim.

16. From the complaint herein, it is evident that a justiciable controversy exists between the parties under the patent laws of the United States, subject to the Declaratory Judgment Act.

17. The BT antennas charged in the complaint as infringements of the Isbell Patent No. 3,210,767, do not use the invention purported to be covered by the claims of said

patent, but, to the contrary, are designed in accordance with BT's own patent, Exhibit A, and do not infringe the Isbell Patent No. 3,210,767.

18. Isbell Patent No. 3,210,767 is invalid and void for double-patenting over the Foundation's earlier Patent No. 3,108,280, issued October 22, 1963, and possibly other patents, and since Isbell is not the first inventor of the subject matter purported to be covered thereby, the same having previously been invented by others and having been published and/or placed on public sale in this country more than one year prior to the application for said Isbell patent by the following, and possibly others, whom counterclaimant prays leave to add by amendment to this count, after discovery proceedings:

U. S. Patent No. 2,429,629, issued October 28, 1947 to A. G. Kandoian

2,433,804, issued Dec. 30, 1947 to I. Wolff

2,375,580, issued May 18, 1945 to H. O. Peterson

2,192,532, issued March 5, 1940 to M. Katzin

2,149,726, issued March 7, 1939 to P. S. Carter.

19. Isbell Patent No. 3,210,767 is unenforceable against counterclaimant in view of the inequitable conduct of the Foundation above set forth.

Wherefore, counterclaimant prays for preliminary and permanent injunctions restraining the acts of unfair competition, anti-trust violation and patent infringement complained of herein, and for a declaratory judgment that counterclaimant BT's antennas do not infringe Isbell Patent No. 3,210,767 and/or that said patent is invalid, void

and unenforceable, and, in view of the wanton character of the illegal conduct of the Foundation and JFD, triple damages and attorneys fees, as provided for by statute, together with such other and further relief as may seem proper to the Court.

Hofgren, Wegner, Allen, Stellman & McCord,
By John Rex Allen,
Attorneys for Defendant and Counterclaimant.

Rines and Rines,
Robert H. Rines,
David Rines,
10 Post Office Square,
Boston 9, Massachusetts,
Of Counsel.

Receipt of two copies of the above Answer and Counterclaim acknowledged this 1st day of September, 1966.

W. A. Marshall,
Attorney for Plaintiff and Counterclaimant Defendant.

Exhibit A

July 5, 1966 I. S. BLONDER ET AL 3,259,904

ANTENNA HAVING COMBINED SUPPORT AND LEAD-IN

Filed Nov. 21, 1963

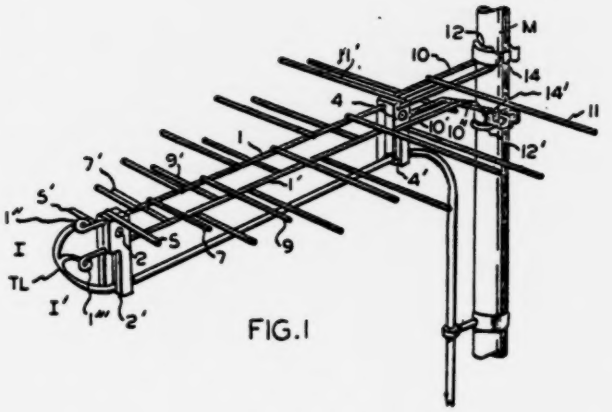

FIG.1

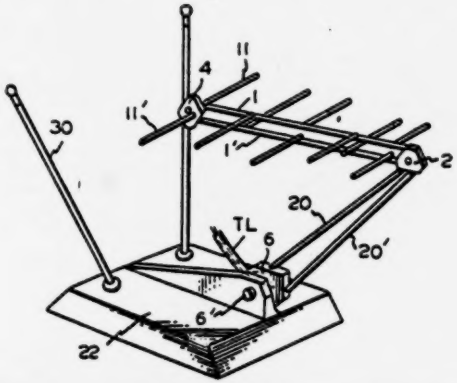

FIG. 2

INVENTORS
ISAAC S. BLONDER
ABRAHAM SCHENFELD

United States Patent Office

3,259,904
Patented July 5, 1966

3,259,904

ANTENNA HAVING COMBINED SUPPORT AND LEAD-IN

Isaac S. Blonder, West Orange, N.J., and Abraham Schenfeld, New York, N.Y., assignors to Blonder-Tongue Electronics, Newark, N.J., a corporation of New Jersey

Filed Nov. 21, 1963, Ser. No. 325,511
6 Claims. (Cl. 343—792.5)

The present invention relates to directive antennas and, more specifically, to antennas adapted for receiving very high frequencies, such as the ultra-high-frequency television band.

Numerous types of antennas have been evolved for broad-band directive radio and television reception including driven arrays, Yagi-type arrays, log periodic linear and V-type antennas, helical antennas and other configurations. The problems of mounting such antennas upon, masts for outdoor operation or upon portable structures adapted for directional adjustment in connection with indoor reception have, however, long plagued the art; the mounting and adjusting structures introducing "ghosts" and other deleterious electrical field-pattern aberrations over the band. It is to the improvement of such mounting structures and the minimizing of electrical interfering effects over a wide band of frequencies, including stabilizing of outdoor performance and providing for ready adjustability in indoor performance, that the present invention is primarily directed.

A further object of the invention is to provide a new and improved antenna particularly adapted for ultra-high-frequency television reception.

Still another object is to provide a novel antenna of improved performance for more general use, also.

Other objects will be made more evident hereinafter and will be particularly pointed out in the appended claims. In summary, however, the invention contemplates a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for feeding the energy received by the antenna at the said one end of the conductors, and means for mounting the antenna comprising a further pair of rigid, preferably diverging, conductive extensions of the said conductors mechanically secured in rigid spaced-apart relation at the end thereof. Further preferred details are hereinafter set forth.

The invention will now be described in connection with the accompanying drawing, FIG. 1 of which is an isometric view of an outdoor preferred embodiment thereof; and

FIG. 2 is a similar view of a modified indoor version.

Referring to FIG. 1, the antenna comprises a pair of rigid conductors 1, 1' held spaced apart a predetermined vertical distance in a vertical plane by forward and rearward insulating clamps 2 and 4. While the terms "vertical" and "horizontal" as herein employed describe the preferred orientation for ultra-high-frequency television reception, they are intended more generically to be illustrative of relative orientations without being confined to actual direction. Similarly, though the invention is described in connection with radio-wave reception, the antenna may also be used for transmission, if desired, as is well known.

Unlike prior-art arrays, including Yagi arrays, conventional log-periodic structure and the like, first and second pluralities of horizontal dipole elements 5, 7, 9 . . . 11 and 5', 7', 9' . . . 11' are provided, lying in corresponding first and second vertically spaced horizontal planes 1 and 1' containing the respective longitudinal conductors 1 and 1'. The dipole elements are shown angularly extending transversely from opposite sides of each conductor at successive points therealong. The dipole elements connected to one conductor, moreover, extend in opposite horizontal directions to the corresponding dipole elements of the other conductor (such as 5 to the right 5' to the left; 7 to the right, 7' to the left; and so on). The length of the dipole elements preferably successively increases from one end (5, 5' being shortest) towards the other end (11, 11' being longest), as is well known, to provide directivity. A parallel-wire transmission line TL is connected at looped terminal portions 1" and 1"' beyond the clamp 2 that secures the connecting portions 1" and 1"' in spaced-apart relation, extending outside or to the left of the smallest dipole elements 5, 5'. The line TL may be supported below the antenna by depending guides 2' and 4' in the respective clamps 2 and 4, the latter being shown positioned near the largest dipole elements 11, 11'.

The antenna of FIG. 1 is mounted upon a mast M through the use of pairs of horizontally spaced conductor-loop extensions 10 and 10', shown extending to the right beyond the longest dipole elements 11, 11'. The extensions 10, 10', respectively, terminate in upwardly and downwardly extending vertical loops 12 and 12' that may be transversely curved to fit the mast M, as shown, and are securely mechanically strapped at 14 and 14' to the mast to hold the system 1–1' in rigid spaced-apart relation at the mast end. Further to aid in mechanical stability, the extension 10', while in part initially extending in the lower horizontal plane 1', diverges downwardly at 10". Fortuitously, this mechanical stability-providing diverging construction has been found minimally to affect the electrical field pattern, particularly if the length of the extension between the longest elements 11, 11' and the mast M is made comparable to the separation along conductors 1 and 1' of the last dipole elements 11 from the next-to-the-last element, to its left in FIG. 1. Minimal field abberations and "ghost" reflections over the complete ultra-high-frequency band, for example, has been thus attained with the above construction, together with satisfactory broad-band impedance matching, provided further that the vertical separation distance of the rigid conductors 1, 1' is kept less than the average distance between successive dipole elements (preferably the order of an inch for UHF band operation), and which, in turn, is kept much less than the wavelengths involved, as is well known. At the UHF channel 47 frequency, for example (671 megacycles), a 20 decibel front-to-back ratio has been obtained with this construction, providing about a 36-degree half-power horizontal beam width and no detectable forward secondary lobes.

This same general type of construction has also been found admirably suited for indoor direction adjustable antennas, as shown in FIG. 2. In this embodiment, however, the small-dipole end of the antenna is used not only for the connection to the transmission line, but also for the support-providing extensions. These extensions are illustrated as rigid conductors 20 and 20' depending at preferably an acute angle below the antenna at the insulating clamp 2 and slightly diverging for mechanical and impedance-matching purposes, being clamped at their bottom or free ends by a further insulating clamp 6. The transmission line TL is thus connected to the conductors 1 and 1' by these combined extension-supporting and transmission-line feed members 20, 20'. The clamp 6 is pivoted at 6' to a bracket carried by a base 22 so that the

members 1–1', 20–20' may be adjusted as a unit for both electrical impedance-matching purposes and appropriate pivoting action for reception-direction adjustment, the length of the preferably diverging extension lines 20, 20' is made substantially equal to the length of the rigid antenna-supporting conductors 1, 1'.

If VHF reception is also to be provided, it has been found that minimal interference is caused by the antenna of the present invention if V-type VHF dipoles 30 are mounted on the base forward of the pivoted clamp 6 and with a sufficient included angle in the V to contain the array of the invention.

Further modifications will occur to those skilled in the art and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. An antenna for ultra-high-frequency operation and the like, having, in combination, a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors and means for mounting the antenna comprising a further pair of rigid diverging conductive extensions of said conductors mechanically secured in rigid spaced-apart relation at an end thereof, the said diverging conductive extensions being provided at the said other end of the pair of rigid conductors and each comprising a pair of horizontally spaced conductors terminally provided with a vertical loop, and the said mechanical securing means comprising mast-strapping means for strapping the said vertical loops, and the distance of the said mast-strapping loops from the said other end being comparable to the distance between the longest and next-to-longest pairs of dipole elements of the antenna.

2. An antenna for ultra-high-frequency operation and the like, having, in combination, a pair of rigid conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of horizontal dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite horizontal directions to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors and means for mounting the antenna comprising a further pair of rigid diverging conductive extensions of said conductors mechanically secured in rigid spaced-apart relation at an end thereof, the transmission-line connecting means and the diverging conductive extensions being combined and extending downward from the said one end to include an acute angle between the dipole carrying conductors and their extensions.

3. An antenna as claimed in claim 2 and in which the conductive extensions are clamped at their free ends against relative movement with the clamp being pivotally mounted upon a base to permit adjustment, as a unit, of the dipole-carrying conductors and their extensions.

4. An antenna as claimed in claim 3 and in which a pair of V-type dipole elements for different frequency reception, are mounted on the said base forward of the pivotal clamp, with the said horizontal dipole elements contained within the V.

5. An antenna for operation over a predetermined frequency band, having, in combination, a pair of rigid longitudinal conductors held spaced a predetermined vertical distance apart in a vertical plane, first and second pluralities of dipole elements lying in corresponding first and second vertically spaced horizontal planes containing the respective conductors, the dipole elements extending from opposite sides of and transversely at an angle to each conductor at successive points therealong with dipole elements connected to one conductor extending in opposite direction to the corresponding dipole elements of the other conductor, the length of the dipole elements successively increasing from one end of the conductors towards the other end thereof, means for connecting a parallel-wire transmission line to the said one end of the conductors, rigid insulating means securing the said connecting means mechanically in spaced-apart relation and connected with means for supporting the transmission line near the said one end, and means for mounting the antenna at a region of the said conductors remote from the said one end, further rigid insulating means being provided for securing the said longitudinal conductors mechanically in rigid spaced-apart relation near the said region, the said vertical distance being less than the distances between the said successive points and less than the wavelengths of the said band.

6. An antenna as claimed in claim 2 and in which the lengths of the said conductors and of their extensions are substantially equal.

References Cited by the Examiner

UNITED STATES PATENTS

3,086,206	4/1963	Greenberg	343—815
3,108,280	10/1963	Mayes et al.	343—792.5
3,134,979	5/1964	Bell	343—792.5
3,150,376	9/1964	Carrel et al.	343—792.5
3,210,767	10/1965	Isbell	343—792.5
3,212,094	10/1965	Berry	343—792.5

HERMAN KARL SAALBACH, *Primary Examiner.*

C. BARAFF, E. LIEBERMAN, *Assistant Examiners.*

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

PLAINTIFF'S REPLY TO COUNTERCLAIM OF DEFENDANT BLONDER-TONGUE LABORATORIES, INC.

1. Summary of Counterclaim Paragraph 1. Counterclaimant Blonder-Tongue Laboratories, Inc. (BT) is a corporation of the State of New Jersey, having a principal place of business in Newark, New Jersey.

Plaintiff admits the allegations of paragraph 1.

2. Summary of Counterclaim Paragraph 2. The University of Illinois Foundation (Foundation) and the University of Illinois are non-profit corporations of the State of Illinois, the Foundation being owned and controlled by the University.

Plaintiff admits that both the University of Illinois Foundation and the University of Illinois are non-profit corporations organized and existing under the laws of the State of Illinois and that each has a place of business in Urbana, Illinois. Plaintiff denies that it is owned or controlled by the University of Illinois or that it is an alter ego of said University.

3. Summary of Counterclaim Paragraph 3. JFD Electronics Corporation (JFD) is a corporation of the State of New York and has engaged with the Foundation in acts of unfair competition.

Plaintiff denies that it has engaged in any acts of unfair competition or in any of the other purportedly actionable activities set forth in the counterclaim, either with JFD or with anyone else. As to the other allegations of the pragraph, plaintiff is without sufficient knowledge or information with which to form a belief as to the truth thereof.

Count I—For Unfair Competition.

4. Summary of Counterclaim Paragraph 4. Statement of jurisdiction.

The allegations of paragraph 4 are admitted, except that plaintiff is without sufficient knowledge or information to form a belief as to whether the amount in controversy under this count exceeds ten thousand dollars.

5. Summary of Counterclaim Paragraph 5. The Foundation has exclusively licensed Isbell Patent No. 3,210,767 to JFD in certain fields.

Plaintiff admits that it has exclusively licensed JFD under Isbell Patent No. 3,210,767 in the field of receiving antennas for television and FM broadcasting for a royalty based on a percentage of the sales of antennas covered by the patent which are manufactured and sold by JFD. The other allegations of the paragraph are denied.

6. Summary of Counterclaim Paragraph 6. The Foundation has the primary responsibility of policing the patent and aiding the commercial sale of antennas by JFD.

Plaintiff admits that, under the terms of its contract with JFD, it has the primary right to police Patent No. 3,210,767 against infringement, but denies that it has the primary responsibility to do so. The other allegations of the paragraph are denied.

7. Summary of Counterclaim Paragraph 7. The Foundation and JFD have conspired to restrain competition.

The allegations of this paragraph, including subparagraphs (a) through (j) are denied.

Count II—Anti-Trust.

8. Counterclaim Paragraph 8. This count arises under the anti-trust laws of the United States, including the Sherman and Clayton Acts, as amended.

Plaintiff is without sufficient knowledge or information

to form a belief as to the truth of the allegation of this paragraph, particularly in view of the failure of the counterclaim to set forth the particular section(s) of the antitrust law or laws on which BT is relying.

9. Summary of Counterclaim Paragraph 9. Reallegation of counterclaim paragraphs 1-7.

Plaintiff reasserts its answers to paragraphs 1-7 of the counterclaim. Plaintiff is without sufficient knowledge or information to form a belief as to whether JFD is one of the largest antenna manufacturers in the United States. Plaintiff denies the other allegations of the paragraph.

Count III—Patent Infringement.

10. Counterclaim Paragraph 10. This count arises under the patent laws of the United States.

The allegation of this paragraph is admitted.

11. Counterclaim Paragraph 11. Counterclaimant reasserts the allegations of paragraphs 1-9 of this counterclaim.

Plaintiff reasserts its answers to paragraphs 1-9.

12. Summary of Counterclaim Paragraph 12. BT is the owner of Patent No. 3,259,904, which was legally issued.

Plaintiff admits that Patent No. 3,259,904 was issued on July 5, 1966, but denies that it was legally issued. Plaintiff is without sufficient knowledge or information to form a belief as to whether BT is now the owner of this patent.

13. Summary of Counterclaim Paragraph 13. Patent No. 3,259,904 covers antennas manufactured by BT.

Plaintiff admits that it charges that the Golden Dart and Golden Arrow antennas manufactured by BT infringe Isbell Patent No. 3,210,767, but it is without sufficient knowledge or information to form a belief as to whether these antennas are covered by Patent No. 3,259,904.

14. Summary of Counterclaim Paragraph 14. Plaintiff infringes Patent No. 3,259,904.

The allegations of this paragraph are denied.

Count IV—Declaratory Judgment.

15. Counterclaim Paragraph 15. Counterclaimant reasserts the allegations of paragraphs 1-14 of this counterclaim.

Plaintiff reasserts its answers to paragraphs 1-14.

16. Summary of Counterclaim Paragraph 16. A justiciable controversy exists between the parties.

The allegations of this paragraph are admitted.

17. Summary of Counterclaim Paragraph 17. The BT antennas, charged by plaintiff to infringe, are not covered by the claims of Isbell Patent No. 3,210,767.

Plaintiff is without sufficient knowledge or information to form a belief as to whether the BT antennas charged as infringements of Isbell Patent 3,210,767 are covered by Patent No. 3,259,904. The other allegations of the paragraph are denied.

18. Summary of Counterclaim Paragraph 18. Isbell Patent No. 3,210,767 is invalid and void.

The allegations of this paragraph are denied.

19. Summary of Counterclaim Paragraph 19. Isbell Patent No. 3,210,767 is unenforceable against BT.

The allegation of this paragraph is denied.

Wherefore, plaintiff prays that the counterclaim be dismissed in its entirety with costs to plaintiff.

Merriam, Marshall, Shapiro & Klose,
By: Basil P. Mann,
A member of the Firm,
Attorneys for Plaintiff,
30 West Monroe Street,
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Area Code 312—346-5750.

Charles J. Merriam,
William A. Marshall,
Basil P. Mann,
Merriam, Marshall, Shapiro & Klose,
30 West Monroe Street,
Chicago, Illinois 60603,
Area Code 312—346-5750,
Of Counsel.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

COUNTERCLAIM DEFENDANT'S, JFD ELECTRONICS CORPORATION, REPLY TO COUNTERCLAIM OF COUNTERCLAIMANT, BLONDER-TONGUE LABORATORIES, INC., AND CROSS-CLAIM.

Counterclaim defendant, JFD Electronics Corporation (JFD), replies to the Counterclaim herein as follows:

Resume, Paragraph 1: Identity and principal place of business of counterclaimant, Blonder-Tongue Laboratories, Inc. (BT).

Counterclaim defendant admits the allegations of paragraph 1.

Resume, Paragraph 2: The University of Illinois Foundation (Foundation) and the University of Illinois' identity ownership and control.

Upon information and belief, counterclaim defendant admits that the Foundation and University of Illinois are non-profit corporations of the State of Illinois and that each has a place of business in Urbana, Illinois. As to the other allegations, counterclaim defendant is without sufficient knowledge or information with which to form a belief as to the truth thereof.

Resume, Paragraph 3: Identity of JFD Electronics Corporation (JFD) and acts of unfair competition engaged by JFD with the Foundation.

Counterclaim defendant denies all of the allegations of paragraph 3. JFD further states that JFD Electronics Corporation, prior to becoming a party to this lawsuit, was dissolved and is now JFD Electronics Company, a Division of Stratford Retreat House, a religious corporation of the State of New York. JFD Electronics Company, the Divi-

sion, has a place for doing business within this judicial district.

Count I—For Unfair Competition.

Resume, Paragraph 4: Statement of jurisdiction.

Counterclaim defendant is without sufficient knowledge or information to form a belief as to whether the amount in controversy exceeds Ten Thousand Dollars ($10,000.00), and admits the remaining allegations of paragraph 4.

Resume, Paragraph 5: The Foundation has exclusively licensed JFD under Isbell Patent No. 3,210,767 in certain fields.

Counterclaim defendant admits that it is an exclusive licensee under said Isbell patent in the field of receiving antennas for television and FM broadcasting on a royalty basis based on a percentage of sales of antennas covered by the patent. All of the other allegations are denied.

Resume, Paragraph 6: The Foundation has the primary responsibility of policing the patent and aiding the commercial sales of antennas by JFD.

Counterclaim defendant admits that under the terms of the license agreement with the Foundation, the Foundation has the initial responsibility with respect to policing of Patent No. 3,210,767 against infringement and denies all of the other allegations.

Resume, Paragraph 7: The Foundation and JFD have conspired to restrain competition.

The allegations of this paragraph, including subparagraphs (a) through (j) are denied.

Count II—Anti-Trust.

Resume, Paragraph 8: This count arises under the anti-trust laws of the United States, including the Sherman and Clayton Acts, as amended.

Counterclaim defendant is without sufficient knowledge

or information to form a belief as to the truth of the allegations of this paragraph. The particular section or sections of the anti-trust laws charged to have been violated are not identified.

Resume, Paragraph 9: The reallegation of paragraphs 1-7 of Count I of the Counterclaim.

Counterclaim defendant denies the allegations of paragraph 9. Counterclaim defendant is without sufficient knowledge or information to form a belief as to whether it is one of the largest manufacturers of antennas as alleged.

By way of separate and alternative defense to Count II, counterclaim defendant states:

1. Count II fails to state a cause of action.
2. Counterclaimant is without standing as a proper party to maintain the action purported to be set forth in Count II of the Counterclaim.

Count III—Patent Infringement.

Resume, Paragraph 10: This count arises under the patent laws of the United States.

Paragraph 10 is admitted.

Resume, Paragraph 11: Counterclaimant reasserts the allegations of paragraphs 1-9 of the Counterclaim.

Counterclaim defendant reasserts its replies to paragraphs 1-9.

Resume, Paragraph 12: BT is the owner of Patent No. 3,259,904, which was legally issued.

Counterclaim defendant admits the issuance of said patent but denies that it was legally issued. Counterclaim defendant is without sufficient knowledge or information to form a belief as to the alleged ownership of said patent.

Resume, Paragraph 13: Patent No. 3,259,904 covers antennas manufactured by BT.

Counterclaim defendant admits that the Foundation charges that the Golden Dart and Golden Arrow antennas infringe Patent 3,210,767, but is without sufficient knowledge or information to form a belief as to whether these antennas are covered by Patent No. 3,259,904.

Resume, Paragraph 14: Plaintiff and counterclaim defendant infringe Patent 3,259,904.

The allegations of paragraph 14 are denied.

Further answering the Counterclaim and for its further and additional defenses, counterclaim defendant states:

A. United States Patent No. 3,259,904 is invalid because the differences between the subject matter patented and the prior art are such that the subject matter as a whole would have been obvious at the time the alleged invention was made to a person having ordinary skill in the art to which said subject matter pertains.

B. United States Patent No. 3,259,904 is invalid because the subject matter thereof was known or used or invented by others in this country, or patented or described in a printed publication in this or a foreign country before the alleged invention thereof, or patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the filing date of the original application on which said patent issued.

C. United States Patent No. 3,259,904 is invalid because the subject matter therein is clearly disclosed in and lacks any element of invention over the prior art considered by the Patent Office during the prosecution of the application on which the patent issued.

D. United States Patent No. 3,259,904 is invalid because the alleged invention involves no more than the mere exercise of ordinary skill in the art in view of the state of the art at the time of and long prior to the alleged invention

thereof, or more than one year prior to the filing of the original application on which the patent issued, all of which prior art counterclaim defendant reserves the right to specify in accordance with the provisions of Title 35, United States Code, Section 282, for the purpose of relying upon same at the time of trial of this action.

E. United States Patent No. 3,295,904 is invalid in that the specification does not describe the alleged invention or the manner of making and using it in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which the alleged invention pertains, or with which it is most nearly connected, to make and use the same.

F. United States Patent No. 3,295,904 is invalid because there is no claim of the patent which is generic to species of the alleged invention as illustrated in Figures 1 and 2 and described in the specification of said patent.

G. United States Patent No. 3,295,904 if valid at all, is limited by the proceedings in the Patent Office; and in view of the history of the prosecution subsequent to which said patent issued, the claims of said patent as finally issued cannot be interpreted to read upon or include a product, device, or article, or combination thereof, made, used, sold or offered for sale by counterclaim defendant.

G. United States Patent No. 3,295,904, if valid, is so limited by the prior art that the claims of said patent as finally issued cannot be interpreted to read upon or include a product made, used, sold or offered for sale by counterclaim defendant.

Count IV—Declaratory Judgment.

Counterclaim defendant is without sufficient knowledge or information to form a belief as to the truth of the allegations of paragraphs 15 through 19 of the Counterclaim.

Wherefore, counterclaim defendant prays that the Counterclaim be dismissed with costs awarded to counterclaim defendant and for such other and further relief as the court may deem just and proper.

Cross-Claim.

Now comes the counterclaim defendant, JFD Electronics Corporation, by its attorneys, and by way of cross-claim to the Counterclaim herein alleges as follows:

1. This action arises under the patent laws of the United States.

2. Cross-claimant is JFD Electronics Company, a Division of Stratford Retreat House, a religious corporation of the State of New York, and with a place for doing business within this judicial district.

3. Upon information and belief, Blonder-Tongue Laboratories, Inc. (BT) is a New Jersey corporation having its principal place of business at 9 Alling Street, Newark, New Jersey.

4. BT has violated the provisions of Title 35, United States Code, Section 292, by marking upon and using in advertising in connection with its Golden Dart antenna the Patent No. 3,016,510 importing that the same is patented for the purpose of deceiving the public and well knowing that certain Golden Dart antenna was not in any part thereof covered by said Patent No. 3,016,510.

Wherefore, counterclaim defendant prays for judgment holding that:

(a) Blonder-Tongue Laboratories, Inc. is guilty of violating Title 35, United States Code, Section 292.

(b) Blonder-Tongue Laboratories, Inc. be preliminarily and permanently enjoined from the continued false use of Patent No. 3,016,510 and references to patents in violation of Title 35, United States Code, Section 292(b).

3. Blonder-Tongue Laboratories, Inc. be fined Five Hundred Dollars ($500) for each instance of its false patent marking in violation of Title 35, United States Code, Section 292(b), and that cross-claimant be awarded one-half (½) of the fine imposed upon said defendant by this Court for such false patent markings, as also provided by Title 35, United States Code, Section 292(b).

Silverman & Cass,
By Myron C. Cass,
A Member of the Firms,
105 West Adams Street,
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726-6006,
Attorneys for Counterclaim Defendant.

Of Counsel:
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IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

REPLY OF BLONDER-TONGUE LABORATORIES, INC. TO CROSS-CLAIM OF JFD ELECTRONICS CORPORATION.

Now comes the defendant, Blonder-Tongue Laboratories, Inc. (B-T), by its attorneys, and answers the cross-claim of JFD Electronics Corporation as follows:

1, 2, 3. Paragraphs 1, 2 and 3 of the cross-claim are admitted.

4. B-T admits that the instruction sheet packed with the Golden Dart antenna carries patent number 3,016,510 and that the box in which the Golden Dart antenna is packed and other literature relating to the Golden Dart refer to patented stainless steel stripless screws. The other allegations of paragraph 4 are denied.

Wherefore, B-T prays for dismissal of the cross-claim and such other and further relief as the court may find just and proper.

Hofgren, Wegner, Allen,
Stellman & McCord,
By Richard S. Phillips,
Attorneys for Defendant and Counterclaimant.

Of Counsel:
Rines and Rines,
Robert H. Rines,
David Rines,
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UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date Jan 13 1967.

Title of Cause University of Illinois Foundation v. Blonder-Tongue Laboratories, Inc., et al.

On Court's Motion, Cause will be added to the trial call on Feb 20 1967.

Counsel required to be ready for trial.

Jan 16 1967

Judge Hoffman.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

AMENDED COMPLAINT.

1. Plaintiff, the University of Illinois Foundation, is a non-profit corporation organized under the laws of the State of Illinois and has its place of business at Urbana, Illinois.

2. Defendant, Blonder-Tongue Laboratories, Inc., is a corporation organized under the laws of the State of New Jersey and has its principal place of business at 9 Alling Street, Newark, New Jersey.

3. This is a suit for patent infringement arising under the patent laws of the United States.

4. United States Letters Patent No. 3,210,767 was duly and legally issued to Plaintiff on October 5, 1965, as assignee of Dwight E. Isbell. Plaintiff is the owner of said patent and of all rights of recovery thereunder.

5. United States Letters Patent No. Re. 25,740 was duly and legally issued to Plaintiff on March 9, 1965, as assignee of Paul E. Mayes and Robert L. Carrel. Plaintiff is the owner of said patent and of all rights of recovery thereunder.

6. Defendant, Blonder-Tongue Laboratories, Inc., is infringing said Letters Patents by making or causing to be made or sold, without license from plaintiff, radio and television antennas embodying the inventions of said patents within this District and elsewhere in the United States and will continue to do so unless enjoined by this Court.

Wherefore, plaintiff prays for the issuance of a judgment providing that:

1. Plaintiff is the owner of United States Letters Patent Nos. 3,210,767 and Re. 25,740 and of all rights of recovery thereunder;

2. Said Letters Patent Nos. 3,210,767 and Re. 25,740 are good and valid in law and have been infringed by defendant, Blonder-Tongue Laboratories, Inc.

3. An injunction be issued enjoining defendant, Blonder-Tongue Laboratories, Inc., from further infringement of said patents permanently and during pendency of this suit.

4. An accounting be had to determine the damages to which plaintiff is entitled for such infringement and that the damages so ascertained be awarded to plaintiff, together with interest;

5. Plaintiff be granted its costs of this action and such other and further relief as may seem proper to the Court.

Merriam, Marshall, Shapiro & Klose,
By Basil P. Mann,
A Member of the Firm,
Attorneys for Plaintiff,
30 West Monroe Street,
Chicago, Illinois 60603,
Area Code 312—346-5750.

Date: Jan. 13, 1967.

Of Counsel:
Charles J. Merriam,
William A. Marshall,
Basil P. Mann,
Merriam, Marshall, Shapiro & Klose,
30 West Monroe Street,
Chicago, Illinois 60603,
Area Code 312—346-5750.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

AMENDED ANSWER AND COUNTERCLAIM.

Amended Answer.

Now comes the defendant, Blonder-Tongue Laboratories, Inc. (hereinafter referred to as BT), by its attorneys, and answers the amended complaint herein, pursuant to this Court's order of January 16, 1967, as follows.

1, 2, 3. Paragraphs 1, 2 and 3 of the amended complaint are admitted.

4. Answering paragraph 4 of the amended complaint, defendant denies that United States Letters Patent No. 3,210,767 was either duly or legally issued to plaintiff, as assignee of Dwight E. Isbell, though admitting that such a patent in fact exists; and defendant is without sufficient information and belief to admit or deny the remaining allegations of this paragraph and therefore leaves plaintiff to its proof.

5. Answering paragraph 5 of the amended complaint, defendant denies that United States Letters Patent No. Re. 25,740 was either duly or legally issued to plaintiff, as assignee of Paul E. Mayes et al., though admitting that such a patent in fact exists; and defendant is without sufficient information and belief to admit or deny the remaining allegations of this paragraph and therefore leaves plaintiff to its proof.

6. Defendant denies each and every allegation of paragraph 6 of the amended complaint.

Further answering, defendant states that (a) the accused antennas do not incorporate any patented inventions described or properly claimed in the patents in suit and do

not infringe said patents, assuming, arguendo, their validity; and (b) that said patents in suit are in fact invalid and unenforceable against defendant for the reasons set forth in the amended counterclaim herein.

Wherefore, defendant prays for the dismissal of the amended complaint and for such other and further relief in the premises as to this Court may seem just and proper.

Amended Counterclaim.

Now comes the defendant BT, by its attorneys, and by way of amended counterclaim to the amended complaint herein, alleged as follows:

1, 2, 3. Counterclaimant realleges paragraphs 1, 2 and 3 of the counterclaim.

Count I—For Unfair Competition.

4. Counterclaimant realleges paragraph 4 of the counterclaim.

5. On information and belief, the plaintiff and counterclaim defendant, said Foundation, after acquiring rights under certain so-called log-periodic antenna designs, including title to Isbell Patent No. 3,210,767 and Mayes et al. Patent Re. 25,740, the subject matter of the amended complaint herein, entered into a commercial business arrangement, including a license agreement, with counterclaim defendant JFD to exploit the said antenna designs and patents in the field of receiving antennas for television and FM broadcast, under the terms of which the antennas for said field would be exclusively manufactured and sold by JFD and distributed by JFD from its places of business in Chicago, Illinois, and elsewhere, and moneys received therefrom would be divided between JFD and the Foundation in accordance with certain percentage figures.

6. Further in accordance with said commercial busi-

ness arrangement, on information and belief, the Foundation undertook the primary responsibility of policing said patents and of aiding the commercial sales of the antennas of JFD, in which, as before stated, it shared in the sales returns, by news releases and other advertising media using the name of said Foundation and threatening all manufacturers in the industry (and thus counterclaimant BT) with suit if any so-called log-periodic antennas were made and sold by them, and by announcements and mailings to customers of such other manufacturers, including customers of BT, of suits which were filed and intended suits, regardless of whether such antennas were actually covered by said patents or any other patent of the Foundation or JFD.

7. On information and belief, said Foundation and JFD conspired unlawfully to restrain competition in the field of television and FM broadcast receiving antennas, and jointly and severally have engaged in unlawfully restraining such competition by at least the following acts and possibly others, presently unknown to counterclaimant, but as to which counterclaimant prays leave to add by amendment to this amended counterclaim upon completion of discovery herein:

(a) Publication of copious advertisements in national, technical and popular publications and elsewhere, circulated throughout the United States, including the Northern District of Illinois, using the names of both said Foundation and JFD, knowingly and falsely representing the scope of their patent coverage as embracing all antennas of the so-called log-periodic type, and generally threatening every antenna manufacturer (which includes counterclaimant BT) and customers in said field with patent suit even before the issuance of said Patents No. 3,210,767 and Re. 25,740, illegally to restrain competition in the manufacture and sale of all log-periodic type antennas, including those clearly outside such patent coverage.

7(b) through 7(j). Counterclaimant realleges paragraphs 7(b) through 7(j) of the counterclaim.

Count II—Anti-Trust.

8 and 9. Counterclaimant realleges paragraphs 8 and 9 of the counterclaim.

Count III—Patent Infringement.

10 through 13. Counterclaimant realleges paragraphs 10 through 13 of the counterclaim.

14. As set forth in paragraph 7(g) hereof, JFD and the Foundation changed the design of certain of their antennas to copy the invention covered by the BT patent, Exhibit A, including the JFD models LPV-VU 18, 15, 12, 9 and 6, LPV-TV 19, 16, 13 and 10, and possibly others presently unknown to counterclaimant, and, since the issuance of counterclaimant's patent, and within six years of the filing of this count, have been inducing the public, within the Northern District of Illinois and elsewhere in the United States, to purchase said certain antennas including said Models manufactured by JFD in clear infringement of the rights covered by said BT patent, Exhibit A; and JFD and the Foundation, pursuant to their commercial business arrangement set forth in paragraphs 5-7 hereof, are offering for sale, stocking, distributing and selling, within the Northern District of Illinois and elsewhere in the United States, antennas including said Models above, that embody the invention of and infringe said BT patent, Exhibit A, and will continue so to do unless enjoined by this Court.

Count IV—Declaratory Judgment for Patent Invalidity and/or Non-Infringement of Patent No. 3,210,767.

15. Counterclaimant reasserts the allegations of paragraphs 1 through 14 of this amended counterclaim.

16. From the amended complaint herein, it is evident that a justiciable controversy exists between the parties under the patent laws of the United States, subject to the Declaratory Judgment Act.

17. The BT antennas charged in the amended complaint as infringements of the Isbell Patent No. 3,210,767, do not use the invention purported to be covered by the claims of said patent, but, to the contrary, are designed in accordance with BT's own patent, Exhibit A, and do not infringe the Isbell's Patent No. 3,210,767.

18 & 19. Counterclaimant reasserts the allegations of paragraphs 18 and 19 of the counterclaim.

Count V—Declaratory Judgment for Patent Invalidity and/or Non-Infringement of Patent Re. 25,740.

20. Counterclaimant reasserts the allegations of paragraphs 1 through 14 of the amended counterclaim.

21. From the amended complaint herein, it is evident that a justiciable controversy exists between the parties under the patent laws of the United States subject to the Declaratory Judgment Act.

22. The BT antennas charged in the amended complaint as infringements of Mayes et al. Patent Re. 25,740 do not use the invention purported to be covered by the claims of said patent and do not infringe Mayes et al. Patent Re. 25,740.

23. Mayes et al. Patent Re. 25,740 is invalid and void as Mayes and Carrel were not the first inventors of the subject matter purported to be covered thereby, the same having previously been invented by others and having been

published and/or placed on public sale in this country more than one year prior to the application for the Mayes et al. original patent, by others, whom counterclaimant prays leave to add by amendment to this count, after discovery proceedings.

24. Mayes et al. Patent Re. 25,740 was invalidly reissued as there was no error without deceptive intention in the original patent, as required by 35 U. S. C. 251.

25. Mayes et al. Patent Re. 25,740 is unenforceable against counterclaimant in view of the inequitable conduct of the Foundation above set forth.

Wherefore, counterclaimant prays for preliminary and permanent injunctions restraining the acts of unfair competition, anti-trust violation and patent infringement complained of herein, and for a declaratory judgment that counterclaimant BT's antennas do not infringe Isbell Patent No. 3,210,767 or Mayes et al. Patent Re. 25,740 and/or that said patents are invalid, void and unenforceable, and, in view of the wanton character of the illegal conduct of the Foundation and JFD, triple damages and attorneys fees, as provided for by statute, together with such other and further relief as may seem proper to the Court.

Hofgren, Wegner, Allen, Stellman
& McCord,
By /s/ Richard S. Phillips,
Attorneys for Defendant and Counterclaimant.

Rines and Rines,
Robert H. Rines,
David Rines,
No. 10 Post Office Square,
Boston, Massachusetts 02109,
Of Counsel.

January 23, 1967.

In the United States District Court.

(Title Omitted in Printing)

COUNTERCLAIM DEFENDANT'S REPLY TO AMENDED COUNTERCLAIM OF COUNTERCLAIMANT, AND CROSS-CLAIM.

Counterclaim defendant, JFD Electronics Corporation (JFD), replies to the Amended Counterclaim as follows:

Resume, Introductory paragraph to Amended Counterclaim: Reallegation of paragraphs 1, 2 and 3 of the Counterclaim.

JFD realleges its replies to paragraphs 1, 2 and 3 of the Counterclaim.

Count I—For Unfair Competition.

Resume, Paragraph 4: Reallegation of paragraph 4 of Counterclaim.

JFD realleges its reply to paragraph 4 of the Counterclaim.

Resume, Paragraph 5: The Foundation has exclusively licensed JFD under Isbell Patent No. 3,210,767 and Mayes, et al. Patent Re. 25,740 in certain fields.

JFD admits that it is an exclusive licensee under said patents in the field of receiving antennas for television and FM broadcasting on a royalty basis. All of the other allegations are denied.

Resume, Paragraph 6: The Foundation has the primary responsibility of policing the patents and aiding the commercial sales of antennas by JFD.

JFD admits that under the terms of the license agreement with the Foundation, the Foundation has the initial responsibility with respect to policing of patents against infringement and denies all of the other allegations.

Resume, Paragraph 7: The Foundation and JFD have conspired to restrain competition.

The allegations of this paragraph including sub-paragraphs (a) through (j) are denied.

Count II—Anti-Trust.

Resume, Paragraphs 8 and 9: Paragraphs 8 and 9 of the Counterclaim are realleged.

JFD realleges its replies to paragraphs 8 and 9 of the Counterclaim and reasserts by way of separate and alternative defenses to Count II the defenses asserted in its reply to the Counterclaim.

Count III—Patent Infringement.

Resume, Paragraphs 10 through 13: Paragraphs 10 through 13 of the Counterclaim are realleged.

JFD realleges its replies to paragraphs 10 through 13 of the Counterclaim.

Resume, Paragraph 14: JFD and the Foundation infringe Patent 3,259,904.

The allegations of paragraph 14 are denied.

Further answering the Amended Counterclaim and for its further and additional defenses, counterclaim defendant reasserts paragraphs A through G (second occurrence) of its reply to the Counterclaim.

Counts IV and V—Declaratory Judgment.

JFD is without sufficient knowledge or information to form a belief as to the truth of the allegations of the paragraphs of Counts IV and V.

Wherefore, JFD prays that the Amended Counterclaim be dismissed with costs awarded to JFD and for such other and further relief as the Court may deem just and proper.

Cross-Claim.

Counterclaim defendant realleges all of the paragraphs of its Cross-Claim to the Counterclaim as herein filed, including the prayer for relief as stated therein.

Silverman & Cass,
By /s/ Myron C. Cass,
105 West Adams Street,
Chicago, Illinois 60603,
726-6006,
Attorneys for Counterclaim Defendant.

Of Counsel:
Ostrolenk, Faber, Gerb & Soffen,
10 East 40th Street,
New York, New York 10016.

IN THE UNITED STATES DISTRICT COURT.
(Title Omitted in Printing)

PLAINTIFF'S REPLY TO AMENDED COUNTERCLAIM OF DEFENDANT AND COUNTERCLAIMANT.

1. Summary of Amended Counterclaim Paragraphs 1, 2 and 3. Reallegation of paragraphs 1, 2 and 3 of the Counterclaim.

Plaintiff realleges its replies to paragraphs 1, 2 and 3 of the Counterclaim.

Count I—For Unfair Competition.

4. Summary of Amended Counterclaim Paragraph 4. Reallegation of paragraph 4 of Counterclaim.

Plaintiff realleges its reply to paragraph 4 of the Counterclaim.

5. Summary of Amended Counterclaim Paragraph 5.

The Foundation has exclusively licensed JFD under Isbell Patent No. 3,210,767 and Mayes, et al. Patent Re. 25,740 in certain fields.

Plaintiff admits that it has exclusively licensed JFD under Isbell Patent No. 3,210,767 and Mayes, et al. Patent Re. 25,740 in the field of receiving antennas for television and FM broadcasting for a royalty based on a percentage of the sales of antennas covered by the patents which are manufactured and sold by JFD. The other allegations of the paragraph are denied.

6. Summary of Amended Counterclaim Paragraph 6. The Foundation has the primary responsibility of policing the patents and aiding the commercial sale of antennas by JFD.

Plaintiff admits that, under the terms of its contract with JFD, it has the primary right to police Patent No. 3,210,767 and Re. 25,740 against infringement, but denies that it has the primary responsibility to do so. The other allegations of the paragraph are denied.

7. Summary of Amended Counterclaim Paragraph 7. The Foundation and JFD have conspired to restrain competition.

The allegations of this paragraph, including subparagraphs (a) through (j), are denied.

Count II—Anti-Trust.

8. Amended Counterclaim Paragraphs 8 and 9. Reallegation of paragraphs 8 and 9 of the Counterclaim.

Plaintiff realleges its replies to paragraphs 8 and 9 of the Counterclaim.

Count III—Patent Infringement.

10. Amended Counterclaim Paragraphs 10 through 13. Reallegation of paragraphs 10 through 13 of the Counterclaim.

Plaintiff realleges its replies to paragraphs 10 through 13 of the Counterclaim.

14. Summary of Amended Counterclaim Paragraph 14. Plaintiff infringes Patent 3,259,904.

The allegations of this paragraph are denied.

Count IV—Declaratory Judgment.
(Patent No. 3,210,767).

15. Amended Counterclaim Paragraph 15. Counterclaimant reasserts the allegations of paragraphs 1-14 of this amended counterclaim.

Plaintiff reasserts its answers to paragraphs 1-14.

16. Summary of Amended Counterclaim Paragraph 16. A justiciable controversy exists between the parties.

The allegations of this paragraph are admitted.

17. Summary of Amended Counterclaim Paragraph 17. The BT antennas, charged by plaintiff to infringe, are not covered by the claims of Isbell Patent No. 3,210,767.

Plaintiff is without sufficient knowledge or information to form a belief as to whether the BT antennas charged as infringements of Isbell Patent 3,210,767 are covered by Patent No. 3,259,904. The other allegations of the paragraph are denied.

18. Amended Counterclaim Paragraphs 18 and 19. Paragraphs 18 and 19 of the Counterclaim are realleged.

Plaintiff realleges its replies to Counterclaim Paragraphs 18 and 19.

Count V—Declaratory Judgment.
(Patent Re. 25,740).

20. Amended Counterclaim Paragraph 20. Realleges Paragraphs 1 through 14 of the amended counterclaim.

Plaintiff realleges its replies to paragraphs 1-14.

21. Summary of Amended Counterclaim Paragraph 21. A justiciable controversy exists between the parties.

The allegations of this paragraph are admitted.

22. Summary of Amended Counterclaim Paragraph 22. The BT antennas, charged by plaintiff to infringe, are not covered by the claims of Mayes, et al., Patent Re. 25,740.

The allegations of this paragraph are denied.

23. Summary of Amended Counterclaim Paragraph 23. Mayes, et al. Patent Re. 25,740 is invalid and void.

The allegations of this paragraph are denied.

24. Summary of Amended Counterclaim Paragraph 24. Patent Re. 25,740 was invalidly reissued under 35 U. S. C. 251.

The allegation of this paragraph is denied.

25. Summary of Amended Counterclaim Paragraph 25. Mayes, et al. Patent Re. 25,740 is unenforceable against BT.

The allegation of this paragraph is denied.

Wherefore, plaintiff prays that the Amended Counterclaim be dismissed in its entirety with costs to plaintiff.

Merriam, Marshall Shapiro & Klose,
By: Basil P. Mann,
A Member of the Firm.
Attorneys for Plaintiff,
30 West Monroe Street,
Chicago, Illinois 60603,
Area Code 312-346-5750.

Of Counsel:
Charles J. Merriam,
William A. Marshall,
Basil P. Mann,
Merriam, Marshall, Shapiro & Klose,
30 West Monroe Street,
Chicago, Illinois 60603,
Area Code 312-346-5750.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

REPLY OF BLONDER-TONGUE LABORATORIES INC. TO CROSS-CLAIM OF JFD ELECTRONICS CORPORATION.

Defendant, Blonder-Tongue Laboratories Inc., by its attorneys, answers the realleged cross-claim of JFD Electronics Corporation as follows:

Blonder-Tongue Laboratories Inc. realleges all of the paragraphs of its reply to the cross-claim as herein filed.

Hofgren, Wegner, Allen, Stellman & McCord,
By: Richard S. Phillips,
Attorney for Defendant and Counterclaimant.

February 3, 1967.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

NOTICE OF APPEAL TO COURT OF APPEALS.

Notice is hereby given that Blonder-Tongue Laboratories, Inc., Defendant and Counterclaimant above named, hereby appeals to the United States Court of Appeals for the Seventh Circuit from the final judgment of this Court entered in this action on the 27th day of June, 1968.

/s/ Richard S. Phillips,
Attorneys for Defendant,
Hofgren, Wegner, Allen,
Stellman & McCord,
20 North Wacker Drive,
Chicago, Illinois 60606,
Telephone: 346-1630.

(Affidavit and Certificate of Clerk omitted in Printing.)

IN THE UNITED STATES COURT OF APPEALS.

For the Seventh Circuit.

September Term, 1968 — April Session, 1969

No. 17153
University of Illinois Foundation,
Plaintiff and Counter Defendant-Appellee,
vs.
Blonder-Tongue Laboratories, Inc.,
Defendant and Counter Claimant-Appellant,
vs.
JFD Electronics Corporation,
Counterclaim-Defendant-Appellee.

Appeal from the United States District Court for the Northern District of Illinois, Eastern Division.

February 13, 1970.

Before CASTLE, *Chief Judge,* DUFFY, *Senior Circuit Judge,* and FAIRCHILD, *Circuit Judge.*

FAIRCHILD, *Circuit Judge.*

The University of Illinois Foundation brought action against Blonder-Tongue Laboratories, Inc. for infringement of two patents in the field of radio and television antennas. Blonder-Tongue asserted invalidity of the two patents. JFD Electronics Corporation, licensed under the patents, was made a party, and Blonder-Tongue counterclaimed against JFD (principally) and the Foundation, for unfair competition, violation of antitrust laws, and infringement of a Blonder-Tongue patent.

The district court decided the Foundation's patents were valid and infringed, dismissed the unfair competition and antitrust charges, and found claim 5 of the Blonder-Tongue patent obvious and invalid. Blonder-Tongue has appealed.

Blonder-Tongue argues here, in addition to the merits issues presented to the district court, that it was not given a fair trial.

1. *Alleged deprivation of a fair trial.*

In October, 1967, after a number of postponements for the convenience of one or the other of the parties or the court, trial was set for December 18. Blonder-Tongue asserts that it was ready for trial on that day. The court, however, was unable to reach the matter and held it on call until December 20, then until December 26, then until the 27th, and then until the 28th. Trial began December 28 and lasted to January 16.

During the delay, Blonder-Tongue moved for postponement until at least February 13, showing that Mr. Blonder, its principal officer, and Professor Chu, its expert, could have appeared at a trial beginning December 18, but had conflicting and compelling other commitments in late December and January.[1]

The court denied the motions. The trial scheduled for December 18, but actually begun December 28, lasted more than two weeks. Mr. Blonder did testify. Professor Chu (who had gone to Taiwan in late December) did not, but counsel has not shown the substance of testimony expected from him and not otherwise available. We find no abuse of discretion in proceeding with the trial.

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1. Although reference is made to being deprived of "intended customer and other witnesses" there is no real explanation why these could not have been produced at the trial in January as well as in December.

2. *The patents involved.*

The Foundation is assignee of a patent, No. 3,210,767, issued October 5, 1965 to D. E. Isbell on an application filed May 3, 1960: Frequency Independent Unidirectional Antennas. This patent is reproduced in University of Illinois Foundation v. Winegard Company (S. D. Iowa, 1967), 271 F. Supp. 412, 420-424.

The Foundation is also assignee of a patent, No. Re 25,740, issued March 9, 1965 to P. E. Mayes, et al.: Log Periodic Backward Wave Antenna Array. This patent is a reissue of No. 3,108,280, applied for September 30, 1960.

Blonder-Tongue is assignee of a patent, No. 3,259,904, issued July 5, 1966 to I. P. Blonder et al. on an application filed November 21, 1963: Antenna Having Combined Support and Lead-In.

3. *Alleged Invalidity of Isbell on account of anticipation by publication.*

Isbell was associated with the Antenna Laboratory of the University of Illinois in performance of an Air Force contract. Reports were prepared and distributed from time to time pursuant to the contract. Quarterly Engineering Report No. 2 contained a description of Isbell's investigation of a type of log-periodic antenna, and it is conceded that if this report was published more than one year before May 3, 1960, the patent was invalid under 35 U. S. C. § 102(b). The printer delivered copies of the report to the office of Miss Johnson, technical editor of the Electrical Engineering Research Laboratory, April 30, 1959. Copies were mailed out of Miss Johnson's office, pursuant to the Air Force contract, to persons on the distribution list May 5.

Blonder-Tongue contends that this report was accessible

to the public on and after April 30, 1959 and therefore a printed publication more than one year before May 3, 1960.

It appears that the Engineering Research Laboratory had a "library" or reading room near Miss Johnson's office. It was unattended, and she had the keys to the cabinets in which materials were kept. It is unlikely that a copy of the report in question reached the "library" before May 3. Miss Johnson testified that a report would normally not be processed and made available as a library copy for a week or two after delivery by the printer.

The testimony as to public availability of copies on hand in her office before mail distribution was equivocal. Miss Johnson testified that if counsel had come to her office on April 30 and requested a copy of the report, he would "very likely" have been given one. She believed the copies were "available as a library reference" on the date received in her office.

Miss Johnson's immediate superior testified, however, that it was the policy to distribute quarterly reports to the list supplied by the Air Force before making them available to others.

The finding that the circumstances of the possession of the reports from April 30 to May 5 did not represent publication is not clearly erroneous.

4. *Alleged Obviousness of Isbell.*

We are met at the outset with the fact that the district court for the southern district of Iowa has decided that *Isbell* is invalid for obviousness.[2] That decision was affirmed by the eighth circuit[3] (although one of the district court's findings was deemed erroneous) and certiorari has

2. University of Illinois Foundation v. Winegard Company (1967), 271 F. Supp. 412.

3. (1968), 402 F. 2d 125.

been denied.[4] It would seem sound judicial policy that the adjudication of that issue against the Foundation in one action where it was a party would provide a defense in any other action by the Foundation for infringement of the same patent.[5]

That, however, is not the law in this field. "While the earlier decision may by comity be given great weight in a later litigation and thus persuade the court to render a like decree, it is not res adjudicata and may not be pleaded as a defense."[6]

We approach the carefully stated decisions of the district court and court of appeals in the *Winegard* action with great respect, but our own analysis, on the basis of the record and the findings of fact made by the district court in this action, and after considering the legal conclusions of the district court, leads us to a different result.

We quote here from the opinion of the district court in this action his description of the problem dealt with and the Isbell solution:

"The plaintiff's patents in suit relate to antennas having unidirectional radiation patterns essentially independent of frequency over a wide band of frequencies. The antennas covered by the patents are equally suitable for both the reception and the transmission of radiated electromagnetic energy (which includes radio and television frequency signals), but our primary concern is with their use for television reception. The characteristics desired in an antenna used for the reception of television signals are a function of the nature of frequency transmission. Although the frequency of a transmitted wave remains essentially con-

4. (1969), 394 U. S. 917, 89 S. Ct. 1191, 22 L. Ed. 2d 452.

5. See Bernhard v. Bank of America Nat. Trust & Sav. Ass'n. (1942), 19 Cal. 2d 807, 122 P. 2d 892, 894-895.

6. Triplett v. Lowell (1936), 297 U. S. 638, 642, 56 S. Ct. 645, 647, 80 L. Ed. 949, 952.

stant as the wave moves through space, the strength of the signal decreases with increasing distance. An antenna is used to isolate the desired signal from interfering signals which exist at the point of reception and to make this signal available to the television receiver, via a transmission line, in as large a magnitude as possible.

The characteristics of an antenna which measure its performance are its gain, its bandwidth, its directivity, and its impedance. 'Gain' is the measure of its ability to increase the strength of an incoming signal relative to a fixed standard; high gain is a desired characteristic. 'Bandwidth' is its capacity to receive, without adjustment, signals of different frequencies with essentially constant gain. An antenna whose reception is essentially independent of frequency over a wide band of frequencies is known as a 'wide-band' or 'frequency independent' antenna. 'Directivity' is an antenna's ability to receive signals from one desired direction as compared to all other directions. Television antennas are preferably unidirectional in order to eliminate interference with the desired signal and the 'ghost' images such interference produces. 'Impedance' is a measure of an antenna's ability to transfer energy to the transmission line. An antenna's impedance should match as closely as possible the impedance of the transmission line to prevent the formation of 'ghosts.' In the design of antennas, one desired characteristic is often obtained at the expense of another. The antenna designer's goal, of course, is to achieve the best possible balance of the several different characteristics.

The simplest antenna which has been put to practical use for television reception is the dipole antenna, which consists of a pair of linear components extending from each side of a transmission line fed in the center at the inner ends of the linear components. Shortly after 1954, the log-periodic principle of antenna design was developed.

The structures designed in accordance with this principle have cyclic performance characteristics which repeat periodically as frequency is increased. Although some log-periodic structures have broadband characteristics, most do not. While a log-periodic structure can readily be designed by one using the log-periodic design principle, it cannot be predicted whether such a structure will have broadband characteristics and thus operate successfully as a log-periodic antenna.

The invention covered by the Isbell patent was made by Dwight E. Isbell during the course of his work at the University of Illinois Antenna Laboratory under an Air Force contract. Isbell's invention is a log-periodic antenna which contains a number of dipole elements arranged in a substantially planar, parallel arrangement to form an antenna array. The length of the dipoles vary from one end of the antenna to the other in accordance with a scale factor, a constant less than one, which is used to establish the length of adjacent elements. The spacing between adjacent elements also varies, preferably in the same manner. The dipoles are fed from the end of the antenna having the shortest dipoles by a twin-line feeder which provides a phase reversal of 180 degrees between adjacent dipoles by alternately connecting successive dipole halves. The Isbell antenna provides unidirectional radiation patterns of essentially constant beam width and input impedance for any desired band width.'[7]

The prior art (some of which was not cited by the patent office) is described in *Winegard*, 271 F. Supp. 412, 416-418, and illustrations of portions of the prior art are appendices to that opinion, pp. 425-429.

It is true that the array described by *Isbell* appears similar in several respects to arrays known in the prior

7. An informative description also appears in the district court opinion in *Winegard*, 271 F. Supp. at 414-415.

art: (1) Each dipole consists of two equal rods substantially in line with each other and with a slight separation between their ends at the center of the dipole; (2) the dipoles are parallel to each other and arrayed along an axis through their centers; (3) the length of the dipoles and the spacing between them varies; (4) two transmission lines run along the axis; (5) in any dipole, one of the rods is connected with one transmission line, and the other rod with the other line; (6) in any dipole each rod is conected with the transmission line to which the corresponding rod in each adjacent dipole is not connected.

The significant difference between the *Isbell* array and every array in the prior art which is similar in any of the respects above stated is that in *Isbell,* the lengths of successive dipoles and the spaces between the dipoles are in geometric progression, the ratio in each progression being the same, having a value less than 1, usually between 0.8 and 0.95. The *Isbell* array is logarithmically periodic. "The geometry of log-periodic antenna structures is chosen so that the electrical properties must repeat periodically with the logarithm of the frequency."[8] Dr. Du Hamel testified that the log-periodic concept is one "whereby you design the antenna and all the dimensions so that the electrical performance must repeat periodically with the logarithm of frequency. This implies that the antenna is made of cells which are similar but are not of the same size and that adjacent cells are represented by some • • • constant factor, Tau."

The concept of log-periodic antennas was known in the prior art. The crucial question is whether it would have been obvious to a person having ordinary skill in the art and desiring to produce a frequency independent broadband antenna to construct an array of the familiar dipoles along transmission lines with such relationship between

8. Jasik, Antenna Engineering Handbook, first ed., 1961, 18-10.

the dimensions of successive dipoles as to produce a logarithmically periodic structure.

It is clear, from the record, that not every logarithmically periodic antenna has the desired frequency independent, broadband characteristics. It is also clear that there is no set of principles by which to predict the presence or absence of such characteristics in such structures.

> "There is an infinite variety of log-periodic structures."[9]
>
> • • • • •
>
> "It should be pointed out that many types of log-periodic structures are not broad-band because of either extreme variation over a period of severe end effect which destroys the periodicity of the electrical characteristics. Only the successful structures are described herein. Unfortunately, it is not possible to determine a priori the frequency-independent type of log-periodic antennas.
>
> "Since log-periodic antennas are too complex to analyze by present-day theoretical methods, they must be investigated by logical experimental methods. However, their repetitive nature greatly simplifies the initial experimental investigation because the characteristics need only be measured over one or two periods of frequency. The operation over other periods may be readily predicted. Although a large amount of experimental data has been obtained, much remains to be done."[10]

The exposition of the theory of logarithmically periodic antennas principally relied on by Blonder-Tongue is an article, published in March, 1958, by Drs. Du Hamel and Ore.[11] Although the article asserts the general principle that "the geometry of logarithmically periodic antenna structures is defined so that the pattern and impedance

9. Jasik, op. cit. 18-11.

10. Ibid, 18-13.

11. R. H. Du Hamel and F. R. Ore, Logarithmically Periodic Antenna Designs, 1958, I. R. E. National Convention Record, 139.

repeat periodically with the logarithm of the frequency", the structures described as successful are markedly different in type and configuration from the array of simple dipoles along transmission lines.

Jasik, writing in 1961, says of the Isbell work, after describing more complex structures "A recent and rather simple type of log-periodic antenna is illustrated in Fig. 18-11. It consists of an array of dipoles with lengths and spacings arranged in a log-periodic manner. The dipoles are excited by a uniform two-wire line with the line transposed between adjacent dipoles."[12] He does go on to say: "It may be noticed that this antenna may be derived from that of Fig. 18-9 [two-winged "Trapezoidal Tooth Log Periodic Structure"] by letting the tooth width and the angle [beta] approach zero and then folding the two half structures about the horizontal axis so that the angle [psi] approaches zero." The observation appears correct but we deem it a hind-sight analysis, and not an indication that it would have been obvious to modify previously known figures in the manner indicated and thus produce the Isbell array.

As noted by the district court, Drs. Du Hamel and Ore filed a patent application March 14, 1958[13] describing structures of types which seem significantly different from a dipole array.

Dr. Du Hamel testified that he did not design an antenna using the Isbell configuration "because the design principles which we were working on did not make this an obvious result." He explained that along with the log-periodic configuration concept, and the included angular concept, design had been influenced by another concept, of a self complementary structure, one which meets the

12. Op. cit. p. 18-13.

13. Granted as No. 3,079,602, Feb. 26, 1963: Logarithmically Periodic Rod Antenna.

test that an identical structure would result from replacing the solid with air and the air with solid. "The complementary condition proved to not be a necessary condition in our later work, but we were still led by this to some extent in designing the log-periodic antennas that we did design."

When Dr. Du Hamel learned that the Isbell antenna worked "I was quite surprised at the simplicity of the structure, and my pride was a little bit hurt in that I had not thought of it, too, or first. * * * At first I was somewhat surprised that they worked but after thinking more about it and thinking back, then I was not surprised. At first I was surprised that it did work."

From the record before us, we do not view the situation as one where it was obvious to antenna designers that a simple dipole and the segment of line between it and the next dipole in an array would describe a cell fitting the concept of logarithmically periodic antennas, nor that some arrangement of simple dipoles in geometric progression would be a frequency independent broadband antenna, making it simply a matter of logical experimentation to find one.

With all respect to our brethren of the eighth circuit, who saw the problem at the time of Isbell's work as "one of trial and error with a combination of commonly used elements operating within known principles of electronics and mechanics to achieve a desired result",[14] we conclude, with the district judge here, that the Isbell patent was not invalid for obviousness.

5. *Validity of Mayes patent.*

In the district court, Blonder-Tongue challenged the validity of *Mays* on the grounds of obviousness; that the patentees, Mayes and Carrel, were not the inventors; and

14. 402 F. 2d 128.

that the patent was obtained by fraud on the patent office. Blonder-Tongue has stressed the last two on appeal.

Obviousness.

The district court found that *Mayes* "incorporates the structural characteristics of the Isbell antenna, with one modification: the dipoles in the array are inclined or V'd * * * While the Isbell antenna's dipoles provide a broadband unidirectional antenna with an upper frequency limit established by the length of the shortest dipole in the antenna, the Mayes et al. V shaped elements permit the antenna to be operated over much higher bands of frequency and with increased directivity thus increasing the effective frequency range of the antenna and constituting an improvement over the Isbell invention."

Mayes and Isbell both worked at the Antenna Laboratory. As already seen, the Isbell structure was described in Quarterly Report No. 2, published May 5, 1959. The idea of V'ing the Isbell dipoles was conceived in June 1959. Thus the Isbell disclosure was prior art with respect to *Mayes*, and the difference between subject matter of *Mayes* and prior art is the V shape of the dipoles.

Although we have concluded that it would not have been obvious at the time of the Isbell invention to experiment with arrays of simple dipoles in an effort to find a frequency independent broadband log periodic antenna, we do conclude that, given the Isbell structure, it would have been obvious to experiment with simple modifications of it, such as the V'ing disclosed in *Mayes*.

Although we prefer to rest our decision that *Mayes* is invalid upon the ground of obviousness, the facts which render the other two grounds at least plausible lend support to the conclusion of obviousness.

Invention by another.

On October 6, 1959, Dr. Mayes filled out a form reporting the invention to the Office of Naval Research. One space was designated: "Earliest date and place invention was conceived (*Brief outline of circumstances*)." He inserted the following: "On June 11, 1959, Mr. E. M. Turner of Wright Air Development Center asked if the angles of dipoles on a log period dipole array had been used as a design parameter. This was tried with no significant change in performance. The idea of operating at higher frequencies so that a change would be obtained then lead to the present invention."

The same report indicates that the first operating model was completed June 23 and the first test, with results sufficiently good to call for further testing, was made the same day.

The district court classified the thought behind Turner's question as mere surmise or theory[15] rather than the type of suggestion held to be really the invention in Atlantic Works v. Brady (1883), 107 U. S. 192, 2 S. Ct. 225, 27 L. Ed. 438.

Although Turner's question suggested only one simple change, such change is the whole difference between *Mayes* and *Isbell*. Whether the district court erred on the point or not, the episode is persuasive toward a conclusion of obviousness.

Alleged fraud on the patent office.

On November 6, 1962, during the prosecution of the original Mayes application, the examiner rejected certain claims. He referred to an article by Isbell in I. R. E. Transaction on Antennas and Propagation, published in May, 1960 and stated, in part, "No invention would be involved

15. 1 Deller, Walker on Patents, 2nd ed. § 68.

in merely arranging the Isbell dipoles in some sort of V-shape as taught by Rowland." Although a footnote to the title disclosed that the article was a revised manuscript the original of which had been previously published June 10, 1959, the examiner did not refer to the 1959 publication date, and perhaps overlooked it.

On January 10, 1963, Mayes responded to the action of November 6 by filing an affidavit under Rule 131 of the patent office, asserting that Mayes and his co-applicant, Carrel, completed their invention before May, 1960, the purpose, as counsel wrote the patent office, being "to carry their work back of the date of the publication in the IRE and back of the Isbell application filing date of May 3, 1960." Neither Mayes nor counsel pointed out the fact, known to Mayes, that the Isbell article, with very slight revision, had first been published on June 10, 1959 at about the time of the invention and more than one year prior to the filing date.

Blonder-Tongue argues that a fraud was thus practiced. The district court rejected the allegation of fraud on the principle that an applicant is under no obligation to disclose his knowledge of references, other than those which disclose the same invention, citing Wen Products, Inc. v. Portable Electric Tools, Inc. (7th Cir., 1966), 367 F. 2d 764, 767.

We do not think the *Wen* principle would control a situation where an applicant affirmatively presents a half-truth to the patent office in order to overcome a rejection when he must know that the whole truth would support rather than overcome the rejection. The applicant's knowledge of a fact as to which he knows the patent office is ignorant or mistaken and which would be material under the theory he knows the patent office is applying would impose an obligation of candor.

We are reluctant, however, to find fraud in this instance

because of the circumstance that the article relied on by the patent office itself disclosed the correct first publication date.

But these facts at least detract from the presumption of validity. It is clear that the publication date of June 10, 1959 would, on the theory followed by the examiner, have prevented issuance of the patent. Presumably the same would be true of the publication of Quarterly Report No. 2, May 5, 1959.

6. *Infringement.*

Apparently it is difficult or impossible to construct the Isbell antenna (or similar arrays with two transmission lines) so that all dipole elements lie exactly within one plane. The Isbell patent states that the dipoles are "substantially coplanar". The dipole elements of the accused Blonder-Tongue antennas lie in one of two planes which are about 1/18 of a wavelength* apart. The district court concluded these elements are substantially coplanar, and we agree.

This resolves the only issue argued with respect to the infringement found by the district court. If other issues become important as a result of our decision that *Mayes* is invalid, they will have to be resolved on remand.

7. *Unfair competition and antitrust claims.*

Blonder-Tongue made a series of charges of unfair competition and the like. The allegations included exaggerated claims in advertising, threatened litigation against competitors, improper news releases concerning litigation, intentional patent mismarking, fraud on the patent office, already discussed, raiding of Blonder-Tongue by JFD to

* The parenthetical phrase "(of the order of an inch)" was stricken by the Court, Apr. 12, 1970, on defendant's petition for clarification, reconsideration and rehearing.

recruit key personnel, and attempting to force customers to buy unpatented articles as a condition of obtaining patented ones.

Extended discussion is unnecessary. The best that can be said in any instance is that Blonder-Tongue presented evidence from which the district court might, but was not compelled to, draw inferences supporting the particular charge. Contrary inferences were equally, or more, reasonable. The findings made were not clearly erroneous, the standards applied as to fairness of trade practices were appropriate, and we agree with the conclusions reached.

8. *Obviousness of Blonder patent subject matter.*

The Blonder alleged invention was "primarily directed", according to the specifications, to improvement of mounting structures of antennas, stabilizing of outdoor performance, and providing for ready adjustability in outdoor performance. *Blonder* does not teach a log-periodic arrangement. The very nature of the subject matter suggests that it was directed at the type of problems which might be solved when addressed by persons with ordinary skill in the art.

The district court described the claim at issue as follows:

> "The antenna of Claim 5 comprises a pair of parallel conductors (twin booms) spaced apart vertically in a vertical plane. Dipole elements lying in vertically-spaced horizontal planes extend from the conductors at successive points along the length of the conductors, with dipole lengths increasing gradually from one end of the conductors to the other, the shortest dipoles at the front end of the conductors, where terminals connect a parallel wire transmission line to the antenna. Rigid insulating means, maintaining the terminals spaced apart, are connected with a strain relief or standoff for supporting the transmission line near the front end. Further rigid insulating means main-

tain the conductors' spacing at a region remote from the front end. The vertical distance between conductors is less than the distance between successive dipole elements and less than the wavelengths of the frequency band of the antenna's operation."

Unfortunately for our performance of the task of review, the district court did not describe the scope and content of the prior art, identify the differences between the prior art and claim 5, nor state the level of ordinary skill in the pertinent art. We would prefer that these steps be meticulously taken.[16]

The court did, however, list as prior art a publication, two types of antennas, and 6 patents, all in addition to the patents cited by the patent office. The court concluded that the differences between claim 5 and the prior art would have been obvious.

The Blonder-Tongue briefs also fell short in setting forth the analysis which it would contend ought to have been made.

If we understand its position correctly, Blonder-Tongue places chief reliance upon the fact that while *Isbell* teaches that the two planes in which the dipole elements lie are to be close enough together that the dipoles are substantially coplanar, *Blonder* teaches that the planes may be separated by some distance, but less than the wavelength of the band. A substantial separation of these planes is clearly shown, however, in the 1961 publication cited by the court, Technical Report No. 52, of the Antenna Laboratory.

Mr. Blonder testified that all the mechanical elements in claim 5 were old. Combining them would, we think, have been obvious to a person of ordinary skill in the art.

16. See Cloud v. Standard Packaging Corporation (7th Cir., 1967), 376 F. 2d 384; Gass v. Montgomery Ward & Co. (7th Cir., 1967), 387 F. 2d 129; United States Gypsum Company v. National Gypsum Company (7th Cir., 1967), 387 F. 2d 799, 801-802, cert. den. 390 U. S. 988, 88 S. Ct. 1184, 19 L. Ed. 2d 1292.

Insofar as the judgment determined that Reissue Patent No. 25740 is valid and enforceable, enjoined infringement thereof, and provided for the determination and award of damages for such infringement, the judgment is reversed and the cause remanded for such further proceedings as may be required, consistent with this opinion. In all other respects, the judgment is affirmed. Defendant Blonder-Tongue shall recover from plaintiff Foundation one-third of its costs on appeal.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

MEMORANDUM OF DECISION.

Julius J. Hoffman, District Judge. The plaintiff and counterclaim defendant, The University of Illinois Foundation (hereinafter "the Foundation"), brings this suit, charging the infringement of two patents, against the defendant and counterclaimant, Blonder-Tongue Laboratories, Inc. (hereinafter "Blonder-Tongue"). The plaintiff is a not-for-profit corporation established under the laws of the State of Illinois and having its place of business in Champaign, Illinois. One of the Foundation's functions is to hold and administer patents covering inventions developed at the University of Illinois. Blonder-Tongue, a New Jersey corporation with its principal place of business in Newark, New Jersey, is engaged in the manufacture and sale of equipment, including antennas, for the distribution and reception of television signals. The plaintiff alleges that Blonder-Tongue has infringed two patents held by the plaintiff by manufacturing and selling television antennas embodying the inventions of these patents.

Blonder-Tongue has denied the validity of the patents

in suit and has asserted that, even if they were valid, they have not been infringed by Blonder-Tongue. Blonder-Tongue has also denied their enforceability. In addition, Blonder-Tongue has brought a counterclaim against the Foundation and JFD Electronics Corporation (hereinafter "JFD"), a New York corporation in the business of manufacturing and selling, among other products, antennas for use with home television receivers. The counterclaim charges that the Foundation and JFD have been guilty of unfair competition, antitrust violations, and infringement of one claim of a patent held by Blonder-Tongue.

This court has jurisdiction of the cause under 28 U. S. C. § 1338. Blonder-Tongue, which does not have "a regular and established place of business" in this District, was joined as a defendant with one of its Chicago distributors, Allied Radio Corporation, but waived its defense of improper venue and allowed Allied Radio Corporation to be dismissed.

Blonder-Tongue's Motion to Dismiss.

Blonder-Tongue's motion to dismiss the complaint for failure to prove a prima facie case, which this court stated during trial it would decide after the close of all the evidence, is denied.

The Foundation's Patents.

The plaintiff's patents in suit are Patent No. 3,210,767, entitled "Frequency Independent Unidirectional Antennas," which issued to the plaintiff on October 5, 1965, as the assignee of Dwight E. Isbell (hereinafter referred to as the Isbell patent), and Reissue Patent No. 25,740, entitled "Log Periodic Backward Wave Antenna Array," which issued to the plaintiff on March 9, 1965, as the

assiignee of Paul E. Mayes and Robert L. Carrel (hereinafteer referred to as the Mayes et al. patent).

TThe Isbell patent has been previously litigated in the Unitted States District Court for the Southern District of Iowra in *University of Illinois Foundation* v. *Winegard Company,* 271 F. Supp. 412 (S. D. Iowa 1967). The Isbell pateent was there held invalid solely on the issue of obviousnesss. This court is, of course, free to decide the case at bar on tthe basis of the evidence before it. *Triplett* v. *Lowell,* 297 U. S. 638, 642 (1936). Although a patent has been adjuadged invalid in another patent infringement action againinst other defendants, patent owners cannot be deprived "of tthe right to show, if they can, that, as against defendants who have not previously been in court, the patent is validd and infringed." *Aghnides* v. *Holden,* 227 F. 2d 949, 951 ((7th Cir. 1955). On the basis of the evidence before it, this court disagrees with the conclusion reached in the *Wineegard* case and finds both the Isbell patent and the Mayees et al. patent valid and enforceable patents. It further finds that the two patents have been infringed by Blondder-Tongue.

Description of the Patents.

Thee plaintiff's patents in suit relate to antennas having unidirrectional radiation patterns essentially independent of frequeency over a wide band of frequencies. The antennas coverred by the patents are equally suitable for both the receptition and the transmission of radiated electromagnetic energyy (which includes radio and television frequency signals), , but our primary concern is with their use for television reception. The characteristics desired in an antenna used ffor the reception of television signals are a function of thee nature of frequency transmission. Although the frequeency of a transmitted wave remains essentially constant aas the wave moves through space, the strength of the

signal decreases with increasing distance. An antenna is used to isolate the desired signal from interfering signals which exist at the point of reception and to make this signal available to the television receiver, via a transmission line, in as large a magnitude as possible.

The characteristics of an antenna which measures its performance are its gain, its bandwidth, its directivity, and its impedance. "Gain" is the measure of its ability to increase the strength of an incoming signal relative to a fixed standard; high gain is a desired characteristic. "Bandwidth" is its capacity to receive, without adjustment, signals of different frequencies with essentially constant gain. An antenna whose reception is essentially independent of frequency over a wide band of frequencies is known as a "wide-band" or "frequency independent" antenna. "Directivity" is an antenna's ability to receive signals from one desired direction as compared to all other directions. Television antennas are preferably unidirectional in order to eliminate interference with the desired signals and the "ghost" images such interference produces. "Impedance" is a measure of an antenna's ability to transfer energy to the transmission line. An antenna's impedance should match as closely as possible the impedance of the transmission line to prevent the formation of "ghosts." In the design of antennas, one desired characteristic is often obtained at the expense of another. The antenna designer's goal, of course, is to achieve the best possible balance of the several different characteristics.

The simplest antenna which has been put to practical use for television reception is the dipole antenna, which consists of a pair of linear components extending from each side of a transmission line fed in the center at the inner ends of the linear components. Shortly after 1954, the log-periodic principle of antenna design was developed. The structures designed in accordance with this principle have cyclic per-

formance characteristics which repeat periodically as frequency is increased. Although some log-periodic structures have broadband characteristics, most do not. While a log-periodic structure can readily be designed by one using the log-periodic design principle, it cannot be predicted whether such a structure will have broadband characteristics and thus operate successfully as a log-periodic antenna.

The invention covered by the Isbell patent was made by Dwight E. Isbell during the course of his work at the University of Illinois Antenna Laboratory under an Air Force contract. Isbell's invention is a log-periodic antenna which contains a number of dipole elements arranged in a substantially planar, parallel arrangement to form an antenna array. The lengths of the dipoles vary from one end of the antenna to the other in accordance with a scale factor, a constant less than one, which is used to establish the length of adjacent elements. The spacing between adjacent elements also varies, preferably in the same manner. The dipoles are fed from the end of the antenna having the shortest dipoles by a twin-line feeder which provides a phase reversal of 180 degrees between adjacent dipoles by alternately connecting successive dipole halves. The Isbell antenna provides unidirectional radiation patterns of essentially constant beam width and input impedance for any desired band width.

The invention covered by the Mayes et al. patent was made by Paul E. Mayes and Robert L. Carrel during the course of their work at the University of Illinois under the same Air Force contract. Their antenna incorporates the structural characteristics of the Isbell antenna, with one modification: the dipoles in the array are inclined or V'd. The apex formed by the V's points in the same direction as the signal received by the antenna. The dipole element size increases in the same direction. While the Isbell antenna's dipoles provide a broadband unidirectional antenna with

an upper frequency limit established by the length of the shortest dipole in the antenna, the Mayes et al. V-shaped elements permit the antenna to be operated over much higher bands of frequency and with increased directivity, thus increasing the effective frequency range of the antenna and constituting an improvement over the Isbell invention.

Validity of the Patents.

Patentability is dependent upon three conditions explicitly set out in the federal statutes governing patents: novelty and utility, as defined in 35 U. S. C. § 101 and § 102, are non-obviousness, as set out in § 103. *Graham* v. *John Deere Co.*, 383 U. S. 1, 17 (1966). The defendant has charged that the Isbell patent is invalid because it is obvious, is anticipated by two earlier inventions, and was disclosed in a printed publication more than one year prior to the filing of the Isbell application. Blonder-Tongue also charges that the Mayes et al. patent is invalid because it is obvious, was not conceived by its purported inventors but by another, and was secured originally by a fraud upon the Patent Office.

A. The Isbell Patent.

The § 103 condition, non-obviousness, "lends itself to several basic factual inquiries." As the Supreme Court has stated, under § 103,

> the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of

the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

Graham v. *John Deere Co.*, 383 U. S. 1, 17-18 (1966).

The primary inquiry, therefore, is the scope and content of the prior art, the differences between that prior art and the claims at issue, and the level of ordinary skill in the field. Blonder-Tongue asserts that Isbell's invention is obvious in view of the prior art, specifically (1) the K. O. antenna, the Channel Master antenna K. O. model 1023; (2) the Katzin patent, No. 2,192,532; and (3) an article by DuHamel and Ore, entitled "Logarithmically Periodic Antenna Designs," published on March 31, 1958. The court disagrees.

The K. O. antenna, sold commercially by Channel Master Corporation in or about 1955, was an antenna which employed folded dipoles. Such folded dipoles differ significantly from the straight or simple dipoles used by Isbell. Further, there was no pattern in the K. O. antenna's dipole spacing, which first increases, then decreases, then increases again from the back to the front of the antenna. The use of narrow band, simple dipoles in a log-periodic array to achieve a broadband effect was in no way suggested by the K. O. antenna.

The Katzin patent covers an array of dipole elements of differing size and different lengths, arranged in a side-by-side relationship in a plane, continuously tapering in length from one end of the antenna to the other, with smaller spacing between shorter elements than between longer ones. The patent does not exhibit log-periodic design and for this and other reasons does not suggest the Isbell antenna.

The DuHamel and Ore article, in its own language, "reports research on new types of broadband logarithmically periodic antenna structures." The characteristics

of such structures were known in 1958 and the structures themselves are described. But the paper, by its own statement, proves that "no theory has been established which even predicts the types of structures which will give frequency independent operation. * * * Thus, it is felt that a theoretical investigation of this class of antennas would be fruitful." It cannot be said that this article taught a method for designing log-periodic antennas which would predictably operate with frequency independence, and the Isbell patent was not obvious after its publication.

Much evidence in the record established that the design of successful log-periodic antennas was recognized by the art itself to be unpredictable. In brief, the design of such antennas at the time of the Isbell invention (and indeed even now) was a challenge to the inventor. Isbell's success was unpredicted and, the court finds non-obvious to other persons skilled in the art. In order to defeat a meritorious patent it is not enough "to pick out isolated features" in the prior art, "combine them in one particular way with hindsight acquired only from the patent under attack, and then say that no invention would have been involved in selecting those particular features and combining them in the particular way in which the patentee did." *Eversharp, Inc.* v. *Fisher Pen Co., Inc.*, 204 F. Supp. 649, 662-63 (N. D. Ill. 1961.)

As for the "secondary considerations" of obviousness or nonobviousness, such as "commercial success, long felt but unsolved needs, failure of others, etc." this court's conclusion is bolstered still more. Dr. DuHamel, among others, attempted to construct an antenna with the characteristics exhibited by Isbell's and failed. When apprised of it, DuHamel was surprised to learn that such a structure worked. There can scarcely be more convincing proof that Isbell's invention met a "long felt but unsolved need" in the antenna industry.

Apart from raising the question of obviousness, Blonder-Tongue challenges the validity of the Isbell patent on other grounds. First, it claims that the invention was not novel because it was anticipated by the K. O. antenna and the DuHamel et al. patent, No. 3,079,602. For the reasons described above, in the court's discussion of the lack of obviousness, even in view of the K. O. antenna, the court concludes that Isbell's invention was similarly not anticipated by the K. O. antenna. The DuHamel et al. patent, filed March 14, 1958 and patented February 26, 1963, also does not anticipate the Isbell patent. It teaches a logarithmically periodic rod antenna, which is significantly different from a log-periodic antenna consisting of a dipole array, different enough so that DuHamel himself was astonished to learn of the success of the Isbell invention.

Blonder-Tongue also charges that the Isbell antenna was disclosed in a printed publication more than one year prior to the filing of Isbell's application. This question is the last remaining challenge to the Isbell patent. The plaintiff has conceded that the Quarterly Engineering Report No. 2, the publication at issue, "would have anticipated Isbell's invention if it had been published at a sufficiently early date," but argues that there is no competent evidence that the report was in fact published earlier than May 5, 1959. The question here is whether the invention was "described in a printed publication . . . more than one year prior to the date of the application for patent," which would negate patentability under 35 U. S. C. § 102. The application for the Isbell patent was filed on May 3, 1960. Hence it becomes crucial to know the date of "publication" of the quarterly report, which the plaintiff concedes describes the invention sufficiently to come within the meaning of the statute. The plaintiff acknowledges that the report was printed and was physi-

cally available prior to May 3, 1959, but denies that it was "published" earlier than May 5, 1959, on which date the report was mailed to those persons on the distribution list.

The evidence which tends to support the defendant's position on the question of publication is the testimony of Miss Marjorie Johnson in the *Winegard* trial, of record in this case by stipulation. Miss Johnson, whose formal position with the University of Illinois in 1959 was Technical Editor of the Electrical Engineering Research Department, was responsible for distributing Electrical Engineering Laboratory publications, such as the quarterly reports. As part of her duties, Miss Johnson also kept copies of such publications in a "library" of sorts, where, because there were no supervisory personnel, materials were kept in locked cabinets and were generally obtained by request from a member of the publications staff having a key. Miss Johnson testified that the quarterly report involved here was in the publications office on April 30, 1959, and was therefore "available for distribution upon request on that date," although they were not actually distributed to persons on the distribution list until May 5, 1959. If Miss Johnson were truly a librarian and the document had been available in a genuine library, even a very small or a highly specialized library, this court would be compelled by the weight of authority to hold that such availability constituted "publication" within the meaning of § 102. See, e.g., *Hamilton Laboratories, Inc.* v. *Massengill*, 111 F. 2d 584 (6th Cir. 1940). However, the court finds the nature of the availability of the document in this case was not sufficiently "public" in nature to constitute the kind of publication intended by the act, at least until the report was distributed on May 5, 1959. In my view, the document had merely arrived from the printer and had come into the possession of the publications office on April

30, 1959, and although there existed the rather remote possibility that a person knowing of the report might have asked for it and obtained a copy of it on that date, this kind of availability did not represent "publication."

B. The Mayes et al. Patent.

The defendant claims that the Mayes et al. patent is obvious in view of Isbell's prior work and the Carter patent, No. 1,974,387. The Mayes et al. patent represents an improvement over the Isbell patent in that its dipoles are inclined or V'd, permitting the antenna to be operated over much higher bands of frequency and with increased directivity, increasing the effective frequency range. The dipole elements are bent forward at an angle between 50 and 150 degrees, rather than being attached perpendicularly, as in the Isbell patent. The Carter patent teaches an antenna "comprising a pair of angularly disposed linear conductors," but it can hardly be said to teach the considerably more spohisticated Mayes et al. invention. It must be noted here, as observed heretofore with respect to the Isbell invention, that predictions in the field of electronics and particularly in the field of antenna design are undependable. There was no obvious basis for one skilled in the art to take the isolated features shown in the two earlier patents and to combine them as Mayes and Carrel did. Their invention was, the court concludes not obvious.

The two final challenges to the Mayes et al. patent are (1) that it was not conceived by Mayes and Carrel but by another, and (2) that it was secured by a fraud upon the Patent Office. The first contention is based upon Dr. Mayes' "admission" on cross-examination that the V-construction which constitutes the only structural difference between his patent and the Isbell patent "was suggested to him by Mr. Turner of Wright Air Development Cen-

ter." But, a mere suggestion by another is not enough to constitute anticipation sufficient to negate novelty. "The mere mental conception of the desirability of doing something and of the means of doing it will not amount to anticipation. An invention is not anticipated by mere surmises or theories or by inferences as distinguished from disclosures." 1 Deller's *Walker on Patents* (2d ed.) § 68. Turner's suggestion in this instance was not an "invention" and did not anticipate the Mayes and Carrel invention. The second contention is, in brief, that the plaintiff's procuring of the Mayes and Carrel patent was "effected by an entirely misleading affidavit, either prepared willfully or through gross and wanton neglect, perpetrating a fraud on the Patent Office." The defendant makes the further argument that none of the conditions required by law for the granting of a reissue patent obtained in this case. The evidence supports neither of these charges. First, the evidence does not show that Mayes et al. misrepresented any fact to the Patent Office during the prosecution of the patent. Second, Mayes et al. were under no obligation to disclose their knowledge of references, other than those which disclose the identical invention. *Wen Products, Inc.* v. *Portable Electric Tools, Inc.*, 367 F. 2d 764, 767 (7th Cir. 1966).

In conclusion, the court finds both the Isbell and the Mayes et al. patents valid and enforceable patents.

Infringement of the Patents.

The log-periodic antennas sold by the defendant which are asserted to infringe the plaintiff's patent are antennas of two series. The first are in the Golden series, consisting of the Golden Dart and Golden Arrow television antennas, the former the outdoor, the latter the indoor models. These are UHF antennas, designed to receive

television signals transmitted by channels 14 through 83, and are charged with infringing all of the claims of the Isbell patent. It was stipulated by the parties that if the representative antenna, Plaintiff's Exhibit #10, was found to infringe, the other member of the series also infringed. The second series is the Color Ranger series, consisting of the Color Ranger-3, Color Ranger-5, Color Ranger-7, Color Ranger-10, and Color Ranger-15. These are VHF antennas, designed to receive signals transmitted by stations 2 through 13, and are asserted to infringe claims 1 through 5 of the Isbell patent and all of the claims of the Mayes et al. patent The representative antenna is Plaintiff's Exhibit #35. It was stipulated by the parties that if it was found to infringe, all other members of the series also infringed.

The court finds that the Isbell patent is basic to both series of Blonder-Tongue's antennas. All of its claims are infringed by the Golden series, while claims 1 through 5 are infringed by the Color Ranger series. The Color Ranger also infringes all of the claims of the Mayes et al. patent. The court finds that the length of the dipoles and the spacings between adjacent dipoles in the accused Blonder-Tongue antennas follow the log-periodic arrangement disclosed and claimed in the patents in suit. Each of the antennas contains three or more parallel dipoles which vary progressively in length and spacing in accordance with a substantially constant scale factor. The scale factor for length is literally constant, in the Golden series, and the average variation from a constant scale factor for spacing is plus or minus 6%. In the Color Ranger series, the scale factor is literally constant for both length and spacing. The separation in the planar arrangement is one-eighteenth wavelength or less for both series. Although the broader the bandwidth desired, the closer an antenna must conform to the preferred construction of the Isbell

antenna, where broadband requirements are not excessively great (and this is true for many practical applications), satisfactory operation can be obtained with an Isbell antenna whose dipole elements are not arranged in a strictly planar arrangement but are separated by a small fraction of a wavelength. The Blonder-Tongue antennas' dipole elements are separated by not more than one-eighteenth wavelength, making them substantially coplanar. In addition, each of the dipoles is connected by a two-conductor feeder, the conductors of which have the effect of alternately connecting the opposite dipole element of successive dipoles.

Blonder-Tongue's Counterclaim.

The counterclaim filed by Blonder-Tongue against the Foundation and JFD contains three counts. The first two counts charge unfair competition and violations of the antitrust laws; the third charges infringement of Blonder-Tongue's own patent, No. 3,259,904, issued July 5, 1966, to Isaac S. Blonder and Abraham Schenfeld.

Unfair Competition and Antitrust Violations.

Blonder-Tongue's first claim of unfair competition and antitrust violations by the counterclaim defendants is its charge against the advertising campaign utilized by JFD, as licensee under the Foundation's patents, to sell the antennas it produced pursuant to the licensing agreement. Blonder-Tongue describes some of the language employed in JFD advertisements as unfair, but the Court finds that it was within the range of acceptable sales efforts and was not so offensive as to be characterized as "unfair." For example, JFD's use of the phrase, "developed by the antenna research laboratories of the University of Illinois," in connection with its product does not violate this court's notions of what is fair competition in a highly competitive

world. The fair import of this phrase is that the JFD antennas were initially developed by persons at the University, and the factual basis for such a statement is not disputed. The advertisements invariably added that the antennas were adapted for home television used by JFD; this statement is also correct. The advertising effort represented by these statements and others like them cannot be deemed "unfair." See *Drop Dead Co., Inc.* v. *S. C. Johnson & Son., Inc.*, 326 F. 2d 87, 96 (9th Cir. 1963), *cert. denied*, 377 U. S. 907 (1964).

Likewise, the alleged "mismarking" of antennas and advertisements with representations of patent coverage for the JFD antennas which Blonder-Tongue asserts was misleading was not shown by the evidence to be either deliberate or of damaging effect. Its effect, if any, was minimal. There was no convincing evidence to support the conclusion that potential purchasers were influenced by such markings to buy or not to buy either JFD's or its competitors' antennas, or that such markings were deliberately intended to gain an unfair advantage over JFD's competition. *S. W. Farber, Inc.* v. *Texas Instruments, Inc.*, 230 F. Supp. 883, 892 (D. Del. 1964), *aff'd*, 344 F. 2d 957 (3d Cir. 1965), *cert. denied*, 382 U. S. 843 (1965).

Nor was the use of the phrase "the patented log-periodic cellular formula" unfair. JFD maintains that it referred to the antenna itself, a log-periodic antenna using the patented cellular concept. This is a reasonable construction of the phrase: the reader was not necessarily led to believe that JFD had patented the whole concept of log-periodicity. The court's conclusion is that JFD's advertising was not improper. The defendant is entitled neither to an injunction to halt allegedly unfair advertising practices nor to damages resulting from a loss of business allegedly attributable to such practices, since the evidence supports neither claim.

Blonder-Tongue further contends that the counter-claim defendants, particularly the Foundation, undertook an unfair campaign to police its patents by numerous lawsuits and threats of litigation. It is conceded by Blonder-Tongue, as it must be, that there is nothing improper in bringing lawsuits against those believed in good faith to be infringers. But Blonder-Tongue's complaint is that suits were brought "to coerce the trade into dealing with JFD exclusively," that news releases concerning this litigation were "deliberately widely circulated in the trade," and that such practices "far transcend the proper use of patents and patent litigation." A review of the evidence demonstrates clearly that such allegations are wholly without basis in fact. The patentee, in the belief that its patents were valid and infringed (as they have indeed been shown to be), had the right to protect its claims by notifying the trade of alleged infringements. Its activities here were not unreasonable. *Al-Fab Aluminum Fabricators, Inc.* v. *Wagner*, 220 F. Supp. 715 (N. D. Ill. 1963). The argument that it was improper to sue Blonder-Tongue in this District is irrelevant to the claim of unfair practices made here. Blonder-Tongue might have brought timely objection to the venue but chose no to do so, and this court has not, in any case, been shown how the choice of venue has worked to Blonder-Tongue's competitive disadvantage. Even if suit had been brought in Blonder-Tongue's home state of New Jersey, news releases describing the litigation might have been distributed anywhere, including this District. From the standpoint of competition, therefore, it is immaterial that Blonder-Tongue was sued here rather than in any other District.

The claim that the Mayes et al. patent was procured improperly from the Patent Office has been discussed *supra* as part of the court's discussion of the patent's validity. There was no evidence that its procurement constituted unfair competition, as charged by Blonder-Tongue.

Blonder-Tongue makes the further claim that JFD "raided" key personnel from Blonder-Tongue, and that this constituted an unfair competitive practice. The record shows that several persons formerly in Blonder-Tongue's employ were subsequently hired by JFD and that, after the departure of one of these, some records dealing with customers were found to be missing. If the court were free to speculate on the significance of this evidence, it might be tempted to conclude, with Blonder-Tongue, that that company had been (in popular parlance) "raided" by JFD. But more than mere speculation is required to justify such a conclusion. There must be proof, and such proof is lacking here. Those employees later hired by JFD made up a small fraction of the total number of employees who left Blonder-Tongue during the same period of time, and a number of reasons, such as dissatisfaction with Blonder-Tongue, genuinely arrived at, appear from the evidence to have been instrumental in causing the employees to change their positions. The record contains no evidence that JFD "raided" Blonder-Tongue. *Dempster Bros. Inc.* v. *Perfection Steel Body Co.*, 182 F. Supp. 307, 309 (N. D. Ohio 1959).

Blonder-Tongue has also argued that JFD attempted to force its customers to purchase its unpatented products as a "tie-in" with its patented products. Proof of such a practice would constitute, of course, an antitrust violation as well as an unfair competitive practice. *Carbice Corp. of America* v. *American Patents Development Corp.*, 283 U. S. 27 (1931). The only evidence, however, which tends to support this argument is the testimony of a JFD official who admitted that JFD salesmen would try to persuade their customers to handle not only JFD antennas but its other products as well. This is a normal business practice: all salesmen try to sell their entire line of merchandise rather than merely their most popular products. There was no

probative evidence here of any coercion or threats made to customers to force their purchase of the entire JFD line. Only proof of such a compulsory tie-in would permit the court to find either an unfair competitive practice or a violation of the antitrust laws, and such proof is absent in the record.

The court concludes that JFD was not guilty of any wrongful practices with regard to the marketing and sales of their antennas. The role of the Foundation in the activities characterized by Blonder-Tongue as unfair and in violation of the antitrust laws is, on this view of the evidence, immaterial. Whether the Foundation was a "mere licensor" or something more than that is of no importance since the accused practices are not found to be beyond the reasonable bounds of competition.

Infringement of Blonder-Tongue's Patent.

The third count of Blonder-Tongue's counterclaim charges that Claim 5 of the patent held by Blonder-Tongue, the Blonder et al. patent No. 3,259,904, has been infringed by the counterclaim defendants. The antenna of Claim 5 comprises a pair of parallel conductors (twin booms) spaced apart vertically in a verticle plane. Dipole elements lying in vertically-spaced horizontal planes extend from the conductors at successive points along the lengths of the conductors, with dipole lengths increasing gradually from one end of the conductors to the other, the shortest dipoles at the front end of the conductors, where terminals connect a parallel wire transmission line to the antenna. Rigid insulating means, maintaining the terminals spaced apart, are connected with a strain relief or standoff for supporting the transmission line near the front end. Further rigid insulating means maintain the conductors' spacing at a region remote from the front end. The vertical distance between conductors is less than the distance be-

tween successive dipole elements and less than the wavelengths of the frequency band of the antenna's operation.

The court finds that Claim 5 of the Blonder-Tongue patent was obvious at the time it was made and is therefore invalid. The alleged improvement was taught by the following references in the prior art:

1. Technical Report No. 52, published October 1, 1961, entitled "Analysis and Design of the Log-Periodic Antenna," by Robert L. Carrel;

2. the Mayes and Heslin antennas;

3. the prior art patents cited by the Patent Examiner during prosecution of the application for the Blonder-Tongue patent and the Kane, Wickersham et al., Valach, Gross, Winegard, and Callaghan patents.

Claims for Attorneys' Fees.

The plaintiff and the counterclaim defendant have each moved for an award of attorneys' fees in their favor, based upon their claims that the counterclaim was interposed and prosecuted against them in bad faith. The Foundation's claim is based upon 35 U. S. C. § 285, which reads:

> The court in exceptional cases may award reasonable attorney fees to the prevailing party.

JFD's claim is based upon "principles of equity and good practice."

Both claims will be denied. The statutory provision, as well as equity, permits such an award only where extraordinary circumstances exist and it is clear to the court that a gross injustice will be done unless such an award is made. *Siebring* v. *Hansen,* 346 F. 2d 474 (8th Cir. 1965), *cert. denied,* 382 U. S. 943. I do not find that Blonder-Tongue's counterclaim was so vexatious and so unjustified as to make it an "exceptional case" within the ambit to the statute or within the dictates of equity.

Hyster Co. v. *Hunt Foods, Inc.*, 263 F. 2d 130, 134 (7th Cir. 1959). Although the court has not held that the counterclaim was legally proved in any respect, Blonder-Tongue was not clearly acting in bad faith in bringing it before this court.

This memorandum of decision will stand as the Court's findings of fact and conclusions of law within the meaning of Rule 52 of the Federal Rules of Civil Procedure.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

JUDGMENT ORDER.

This cause having come on to be heard on plaintiff's Amended Complaint, on defendant's Amended Answer and Counterclaim, and on plaintiff's and counterclaim defendant's Reply to Amended Counterclaim and the Court having heard the testimony of the Witnesses for the respective parties in open court and having examined the depositions made of record, the exhibits received in evidence and the briefs of the respective parties, and the Court having this day filed its Memorandum of Decision which said Memorandum of Decision stands as the Court's Findings of Fact and Conclusions of Law within the meaning of Rule 52 of the Federal Rules of Civil Procedure,

It Is Hereby Ordered, Adjudged and Decreed as follows:

1. The Court has jurisdiction of the parties and of the subject matter of this action.

2. The plaintiff, University of Illinois Foundation, is the owner of United States Letters Patent No. 3,210,767, and Reissue Patent No. 25,740, and all rights thereunder, including the rights of recovery for past infringements.

3. United States Letters Patent No. 3,210,767 and Reissue Patent No. 25,740 are valid and subsisting at law and enforceable.

4. The defendant, Blonder-Tongue Laboratories, Inc., has infringed said Patents by making or causing to be made or sold antennas covered by the Claims of said Patents.

5. Judgment on the Amended Complaint is entered for the plaintiff with prejudice.

6. The defendant is the owner of United States Letters Patent No. 3,259,904 and all rights thereunder.

7. Claim 5 of United States Letters Patent No. 3,259,-904 is invalid and void in law.

8. The plaintiff and the counterclaim defendant, JFD Electronics Corporation, did not commit acts of unfair competition or acts in violation of the antitrust laws as charged in the Counterclaim.

9. Judgment on the Counterclaim filed by the defendant is entered for the plaintiff and the counterclaim defendant with prejudice.

10. A perpetual injunction shall issue out of and under the seal of this Court directed to the defendant, Blonder-Tongue Laboratories, Inc., their respective officers, agents, servants, attorneys, employees, associates and privies and those persons in active concert and participation with them or any of them, enjoining and restricting them and each of them from directly or indirectly infringing United States Letters Patent No. 3,210,767 and Reissue Patent No. 25,740 and from offering or advertising so to do, and from aiding or abetting or in any way contributing to the infringement of any of said Claims.

11. After this decree shall have become final, the Court shall refer the matter to a Master, to be appointed by the Court, to make and render an accounting as to the extent of the manufacture and sale of infringing antennas by the

defendant, and as to the amount of damages suffered by the plaintiff by reason of the defendant's infringement of United States Letters Patent No. 3,210,767 and Reissue Patent No. 25,740; and that plaintiff recover from the defendant the amount of these damages.

12. The said defendant and its officers, directors, attorneys, servants, agents, workmen and employees are hereby directed and required to attend before such Master, from time to time as required and to produce such relevant apparatus, objects, books, documents and papers as requested and to submit to examination, oral or otherwise.

13. The plaintiff shall not recover its expenses, costs or attorneys' fees.

14. The defendant shall not recover its expenses, costs or attorneys' fees.

15. The counterclaim defendant shall not recover its expenses, costs or attorneys' fees.

Enter:

Julius J. Hoffman,
United States District Judge.

Dated: June 27, 1968.

University of Illinois Foundation,

Appellant,

vs.

Winegard Company,

Appellee.

No. 19000.

UNITED STATES COURT OF APPEALS,

Eighth Circuit.

Sept. 30, 1968.

Rehearing Denied Nov. 5, 1968.

Certiorari Denied March 24, 1969.

Before MATTHES, MEHAFFY and LAY, *Circuit Judges.*
LAY, *Circuit Judge.*

The plaintiff, the University of Illinois Foundation, appeals from a judgment below denying patent validity to its United States Letters Patent No. 3,210,767,[1] relating to a "frequency independent unidirectional antenna." The plaintiff is the owner by assignment from one Dwight E. Isbell. For facility of discussion we refer to the patent itself as the "Isbell Patent." Suit was brought against the defendant Winegard Company for alleged infringement. Trial was held before the Honorable Roy L. Stephenson, Chief Judge of the Southern District of Iowa. Judge Stephenson held that the subject matter of the patent did not rise to the level of patentability and dismissed plaintiff's suit. See University of Illinois Foundation v. Winegard Co., 271 F. Supp. 412 (S. D. Iowa 1967).

1. Plaintiff's assignor filed his application for patent on May 3, 1960.

The Isbell Patent claims a high quality television antenna for color reception, with unidirectional performance over a wide bandwidth of frequencies. The trial court denied validity to the patent in that "it would have been obvious to one ordinarily skilled in the art and wishing to design a frequency independent unidirectional antenna to combine * * * prior art references * * *." Id. at 419.

There is no necessity to set forth the full discussion of the facts relating to the prior art. These appear in the excellent analysis made by the Chief Judge below. We have examined the record and find that all claims must be denied, lacking nonobviousness as a matter of law for essentially the same reasons set forth by the court below.

Plaintiff urges that the trial court erred in denying patent validity and calls our attention to a subsequent decision in a federal district court in Illinois which upholds the validity of the same patent against another defendant, University of Illinois Foundation v. Blonder-Tongue Laboratories, Inc., N. D. Ill., Civ. No. 66 C 567. However, as recognized by the district court in Illinois, we must determine this case on its own record.[2]

The plaintiff basically urges on appeal that the district court in the present case erred in finding that "those skilled in the art at the time of the Isbell application knew * * * the log periodic method of designing frequency independent antennas." On the face of the record we must agree that this finding is erroneous. The record discloses that the log-periodic formula[3] for antenna design was a recog-

2. Compare this court's holding in Imperial Stone Cutters, Inc. v. Schwartz, 370 F. 2d 425 (8 Cir. 1966), invalidating the letters patent previously upheld in 1958 by another panel of our court on a different record in Ezee Stone Cutter Mfg. Co. v. Southwest Indus. Prods., Inc., 262 F. 2d 183 (8 Cir. 1958).

3. As summarized by the trial court:

"Generally stated, log periodic antennas are designed according to the theory that an antenna 'design cell' having high performance characteristics for reception of a limited band or

nized theory within the calling. This formula is discussed in the authoritative article by Drs. Hamel and Ore entitled Logarithmically Periodic Antenna Designs, published in March of 1958. However, as pointed out by plaintiff, this same article discloses:

> "Unfortunately, no theory has been established which even predicts the types of structures which will give frequency independent operation."

Jasik's Antenna Engineering Handbook, a recognized authority in the field, verifies on page 18: "* * * it is not possible to determine *a priori* the frequency independent type of log-periodic antennas." The record is clear that both plaintiff and defendant experts agreed with this fact.

Thus, we feel the evidence only discloses the adaptation by plaintiff of the log-periodic formula to obtain geometric proportional spacing across its bandwidth. It did not teach that said spacing will in itself achieve frequency independent operation. As we view the record it is the achievement of frequency independent operation through the use of the dipole array which is the principal claim of the Isbell Patent. Both parties' experts agree that with frequency independent operation "severe end-effects" and unstable performance is avoided. A frequency independent antenna is one in which the basic electrical characteristics remain substantially constant over a given frequency range. These characteristics generally relate to uniform

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period of radio frequency signals, if altered in all dimensions by a constant scale factor will have high performance characteristics for reception of a band of signals having wavelengths which vary from the wavelengths of the first band of frequencies by the same constant scale factor. Thus, according to the theory, if an antenna design cell has certain characteristics for reception of particular frequency wavelengths, an antenna geometrically similar but reduced in all dimensions by a scale factor of .5 will have similar characteristics for reception of frequencies of wave lengths half those of the first." University of Illinois Foundation v. Winegard Co., 271 F. Supp. 412, 417 (S. D. Iowa 1967).

gain, bandwidth, directivity and a good impedance match. Unless an antenna achieves frequency independent operation it will not offer the high quality performance over a wide band of frequencies needed for commercial operation.

However, we do not view the acknowledged fact of the unpredictability of the frequency independent operation of the Isbell Patent as requiring us to reach a result different than held below. Nor was the trial court's finding in this regard essential to its overall reasoning that the patent itself was made obvious by the prior art. The statutory standard of patentability under § 103 is not "predictability." This terminology helps to obscure the true issue of "nonobviousness." The valid test relates the subject patent to whether its development would be obvious to one skilled in the art. As stated by Mr. Justice Clark, the test of nonobviousness "is one of inquiry, not quality * * *." Graham v. John Deere Co., 383 U. S. 1, 17, 86 S. Ct. 684, 15 L. Ed. 2d 545 (1966). As we have often repeated such inquiry relates to: (1) scope and content of the prior art, (2) differences between the subject patent and the prior art, (3) the level of the skill in the art at the time involved and (4) secondary considerations relating to commercial success, long-felt need, et al. And of course, the latter factors cannot alone determine patentability. National Connector Corp. v. Malco Mfg. Co., 392 F. 2d 766 (8 Cir. 1968).

Therefore, we deem the sole legal issue in the instant case to be whether a person skilled in the calling could improve with the skill of the calling the prior art by obvious means.

The mere fact that the "invention" was not previously known or developed is not the test. Where logical exploration within known principles of the science achieves an unpredictable result, even though a commercially desirable one, the burden of nonobviousness is not necessarily

overcome. In other words, the necessity of logical experimentation does not in and of itself negate obviousness.[4] Cf. General Mills, Inc. v. Pillsbury Co., 378 F. 2d 666 (8 Cir. 1967).

As early asserted by Mr. Justice Bradley in Atlantic Works v. Brady, 107 U. S. 192, 199-200, 2 S. Ct. 225, 231, 27 L. Ed. 438 (1882):

> "The process of development in manufactures creates a constant demand for new appliances, which the skill of ordinary head-workmen and engineers is generally adequate to devise, and which, indeed, are the natural and proper outgrowth of such development. Each step forward prepares the way for the next, and each is usually taken by spontaneous trials and attempts in a hundred different places. To grant to a single party a monopoly of every slight advance made, except where the exercise of invention, somewhat above ordinary mechanical or engineering skill, is distinctly shown, is unjust in principle and injurious in its consequences."

Plaintiff urges Isbell had to overcome two serious handicaps which hid the developmental obviousness: (1) the

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4. In Minnesota Mining & Mfg. Co. v. Coe, 69 App. D. C. 217, 99 F. 2d 986, 989 (1938), the court said:

> "But a showing of great industry in experimental research is not in itself sufficient to constitute invention, when the product thereof differs from those of the prior art only in degree and the result—no matter how useful it may be—is merely one step forward in a gradual process of experimentation."

In Busell Trimmer Co. v. Stevens, 137 U. S. 423, 435, 11 S. Ct. 150, 154, 34 L. Ed. 719 (1890), the United States Supreme Court said:

> "But the patent before us is no such case. The most that can be said of it is that it shows, on the part of Orcutt, great industry in acquiring a thorough knowledge of what others had done in the attempt to trim shoe soles in a rapid and improved mode, by the various devises perfected by patents for that purpose, good judgment in selecting and combining the best of them, with no little mechanical skill in their application; but it presents no discoverable trace of the exercise of original thought."

use of linear dipoles to achieve a broad-band result, and (2) the mismatch of impedance. The simple answer to this argument is that the "problems" presented were never recognized beyond experimental correction by those skilled in the calling. Although linear dipoles may have been used with "narrow-band" antennas, such configuration had been shown to be used with antennas having broad-band characteristics. Defendant's tests demonstrated they had substantially the same characteristics (except impedance) as the "folded dipole." They had been utilized interchangeably by experimental engineers. These equivalent characteristics were known long before the Isbell Patent.

The problem of matching impedance was one of adjustment. However, matching impedance is an elementary problem to those skilled in radio electronics. Impedance is recognized as the resistance to the flow of current. It is fundamental that efficient performance of any antenna occurs only through a maximum power transfer of the transmission line to the antenna itself. This requires matching impedance as much as possible. No claim of 'invention" is asserted to overcome the mismatch, only that the antenna itself was, therefore, not obvious. The ability to match impedance with the linear dipole array was not new to the development and exploration which led to the Isbell antenna. There was not involved the same deterrent as experienced in United States v. Adams, 383 U. S. 39, 86 S. Ct. 708, 15 L. Ed. 2d 572 (1966), where chemicals were interchanged, admittedly non equivalents, to achieve the "water battery." The problem here was one of trial and error with a combination of commonly used elements operating within known principles of electronics and mechanics to achieve a desired result. Cf. Marconi Wireless Tel. Co. of America v. United States, 320 U. S. 1, 63 S. Ct. 1393, 87 L. Ed. 1731 (1942).

In Jasik's Antenna Engineering Handbook it is stated on page 1813:

> "Since log-periodic antennas are too complex to analyze by present-day theoretical methods, they must be investigated by *logical experimental methods.*[5] However their repetitive nature greatly simplifies the initial experimental investigation because the characteristics need only be measured over one or two periods of frequency." (Emphasis ours.)

Plaintiff claims that the frequency independent operation of the Isbell antenna was accomplished by "specified scaling factors to determine dipole length, design cell dimensions, and spacing between dipoles." Here again, the evidence reflects that plaintiff did nothing more than logical and mechanical experimentation within suggested principles and design from the existing art. As the trial court found, there exists a direct relationship between the length and cell dimension of the Isbell claims and those of the prior art found within the K. O. antenna. And plaintiff's own expert discounted the significance of the dipole spacing as a design factor.

Problems of impedance, patterns, resonance, gain, directivity and bandwidth, may all vary upon experimentation within recognized principles of elements having known in-

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5. Mr. Winegard of the defendant company relates the experimental engineers' approach:

> "Well, in the early days I used to calculate the resonance. There's so many factors with respect to the length of the element—if you are just concerned with one dipole, one straight dipole, it would be very easy to determine the actual length by calculation, but when you place several elements together there is always an inter-action which will affect the length, so in order to get optimum performance from an array it is necessary to tune the antenna by silghtly modifying the actual length of the—I have been working with antennas so long it is like learning the English language, you don't have to look at the dictionary every time to figure out how to spell 'and.' You know what I mean?"

terrelated electrical characteristics. And naturally, only high quality performance will be the optimum design array desirable. Such experimental combination of common elements and principles, e.g., dipole array, transposed feed, end fed and log-periodic formula, by selected spacing to obtain an improvement of both antenna design and performance, does not obviate the test of nonobviousness. If this were not true, at least in the instant case, nonobviousness would depend simply upon achieving a new result. The standard of patentability under § 103 requires more.

Judgment affirmed.

University of Illinois Foundation, *Plaintiff*,

v.

Winegard Company, *Defendant*,

Civ. No. 3-695-D.

United States District Court
S. D. Iowa,
Davenport Division.

June 23, 1967.

As Amended July 18, 1967.

MEMORANDUM OPINION.

STEPHENSON, *Chief Judge.*

This action was brought by the plaintiff University of Illinois Foundation, the owner by assignment of U. S. Patent 3,210,767, issued to Dwight E. Isbell on October 5, 1965 (hereinafter referred to as the Isbell Patent and attached hereto as Appendix A), against the defendant Winegard Company wherein the plaintiff seeks a finding that said patent has been and is being infringed by the defendant. In its answer the defendant alleges, *inter alia*, invalidity of the patent on the grounds that the invention was disclosed more than one year prior to the date of the application for the patent and that, at the time made, the invention was obvious to one skilled in the art. Jurisdiction is established by virtue of 35 U. S. C. § 281 and 28 U. S. C. § 1338.

Inasmuch as the defendant alleges invalidity of the patent as a defense, the Court must determine initially whether or not the Isbell patent is valid. General Mills,

Inc. v. Pillsbury Co., 378 F. 2d 666 (8th Cir., 1967); American Infra-Red Radiant Co. v. Lambert Indus., Inc., 360 F. 2d 977, 983-984 (8th Cir., 1966). Of course, a patent, from the fact of its issuance is presumed to be valid. 35 U. S. C. § 282; Radio Corporation of America v. Radio Engineering Laboratories, Inc., 293 U. S. 1, 7-8, 55 S. Ct. 928, 79 L. Ed. 163 (1934); L & A Products, Inc. v. Britt Tech. Corp., 365 F. 2d 83, 86 (8th Cir., 1966); American Infra-Red Radiant Co. v. Lambert Indus., Inc., supra, 360 F. 2d at 988-989. However, this presumption of validity is weakened when, as in this case, there are prior art references or alleged disclosures of the patent before the Court that were not considered by the patent office during the prosecution of the application for the patent. Imperial Stone Cutters, Inc. v. Schwartz, 370 F. 2d 425, 429 (8th Cir., 1966); American Infra-Red Radiant Co. v. Lambert Indus., Inc., supra, 360 F. 2d at 989; Greening Nursery Co. v. J & R Tool & Mfg. Co., 252 F. Supp. 117, 139 (S. D. Iowa, 1966), aff'd, 376 F. 2d 738 (8th Cir., 1967).

There are three separate conditions precedent to patent validity. They are: Novelty, utility and nonobviousness. 35 U. S. C. §§ 101-103; Graham v. John Deere Co., 383 U. S. 1, 12, 86 S. Ct. 684, 15 L. Ed. 2d 545 (1966); United States v. Adams, 383 U. S. 39, 48, 86 S. Ct. 708, 15 L. Ed. 2d 572 (1966); L & A Products, Inc. v. Britt Tech. Corp., supra, 365 F. 2d at 85. In this case the defendant relies on lack of novelty (Title 35 U. S. C. Section 102) and obviousness (Section 103) as barring patentability. It is the opinion of the Court that the issue of obviousness is dispositive of this case. Therefore, that issue will be first considered.

While the ultimate question of patent validity is one of law, the determination of the question of obviousness lends itself to several basic factual inquiries. Graham v. John Deere Co., supra, 383 U. S. at 17, 86 S. Ct. 684; L & A

Products, Inc. v. Britt Tech. Corp., supra, 365 F. 2d at 86. In addition to setting out the scope of the patent in suit, the scope and content of the prior art must be defined so that a determination can be made as to whether the differences between the patent in suit and the pertinent prior art would have been obvious to one ordinarily skilled in the art. If such differences as may exist would have been obvious to a person ordinarily skilled in the art, the obviousness test of 35 U. S. C. § 103 has not been met and the patent will be invalid. Graham v. John Deere Co., supra, 383 U. S. at 37, 86 S. Ct. 684, General Mills, Inc. v. Pillsbury Co., supra.

The Patent in Suit.

The Isbell Patent is entitled "Frequency Independent Unidirectional Antennas" and relates to antennas designed for the transmission and reception of electromagnetic radio frequency signals. These signals are used for the broadcasting of many types of communications including radio and television signals. The Isbell antenna consists of a plurality of elements called "dipoles"[1] which are

1. Generally, in this context, a simple straight dipole antenna element consists of two elongated metallic conductors (wires, rods or tubes) arranged approximately colinearly in such a manner that there is a small gap or terminal between their inner ends, at which point a transmission line is attached. The familiar "rabbit-ear" indoor television antenna is a simple dipole having its arms at an angle rather than in a straight line. When immersed in an electromagnetic field the dipole element will intercept electromagnetic radio waves and produce a voltage across the terminal. This voltage is carried to the receiver by means of the transmission line. The dipole antenna element, like any other electrical conductor, will intercept radio energy from the atmosphere to a limited extent, regardless of the frequency of the energy being transmitted. There is, however, a special condition, known as "resonance", in which the dipole is strongly receptive, which occurs when the dipole is of a particular length in relationship to the wavelength of the radiated energy. This condition occurs primarily when the overall length of the dipole is one-half of the wavelength of the radio wave. Thus,

arranged in relation to each other and connected to each other in a particular manner. Generally, as stated in the patent specification, "the antennas of the invention are coplanar dipole arrays consisting of a number of dipoles arranged in side-by-side relationship in a plane, the length and the spacing between successive dipoles varying according to a definite mathematical formula, each of the dipoles being fed by a common feeder (transmission line) * * *."[2] According to the patent specification,

> The lengths of the dipoles and the spacing between dipoles are related by a constant scale factor τ defined by the following equations:
>
> $$\tau = \frac{L_{(n+1)}}{L_n} = \frac{\Delta S_{(n+1)}}{\Delta S_n}$$
>
> where τ is a constant having a value less than 1, L_n is the length of any intermediate dipole in the array, $L_{(n+1)}$ is the length of the adjacent smaller dipole, ΔS_n is the spacing between the dipole having the length L_n and the adjacent larger dipole, and $\Delta S_{(n+1)}$ is the spacing between the dipole having the length L_n and the adjacent smaller dipole.[3]

The feeder or transmission line consists of two conductors, one of which is connected to the inner end of one-half of each dipole, the other being connected to the inner end of the other half of the dipole, and transposed between connections of successive dipoles in such a manner that each

---

it is apparent that a dipole can be "tuned" for optimum reception of a particular radiowave frequency by adjusting the overall length of the dipole. The relative ability of one antenna to produce a signal (i.e., a radio frequency voltage) at a given location distant from the transmitting station in comparison with another antenna similarly located is a measure of the antenna's "gain," a technical term used in the industry in reference to an antenna's signal-producing capabilities.

2. Isbell Patent, Col. 1, lines 14-19. See App. A.

3. Isbell Patent, Col. 1, lines 50-62. See App. A.

conductor is connected alternately to the left and right halves of successive dipoles. (See Appendix A, Fig. 1.)

Antennas designed in accordance with the patent specifications are claimed to have unidirectional radiation patterns and high quality performance which are, over a wide band of frequencies, essentially independent of the frequency of the electromagnetic radio waves being transmitted or received. An antenna with such characteristics is, of course, desirable when the reception of many different frequencies is required as one such antenna may be used in place of many antennas which are each capable of receiving a limited number of frequencies. Since VHF television signals are broadcast over a range of frequencies of 54 megacycles/second to 216 megacycles/second,[4] an antenna capable of receiving high quality signals with uniform performance characteristics in that range of frequencies would be of commercial utility. This is particularly true in respect to the reception of color television signals where the minimum standards of performance are higher than those required for satisfactory black and white television reception.

There are fifteen claims in the Isbell patent. See Appendix A. All of the claims except numbers 6, 7 and 8 are claimed to be infringed by one or more of twenty-two models of defendant's antennas which are designed for

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4. Channels 2-6 broadcast over radiowave frequencies 54-88 megacycles/second, each channel being assigned a band 6 megacycles wide in which to broadcast. Thus, channel 2 broadcasts over the range 54-59 megacycles/second; channel 3, 60-65 megacycles/second; etc. Channels 7-13 broadcast over frequencies 176-216 megacycles/second, with 89-175 megacycles/second being assigned to non-television broadcasting. While some of the antennas accused of infringing are designed for the reception of VHF and UHF (470-890 megacycles/second) signals, it is only the VHF sections of these antennas that are alleged to be infringements of the Isbell patent.

the reception of television signals.[5] Specifically, all twenty-two models are alleged to be literal infringements of claim 14 and 15 and also within the inventive concept of claims 1-5 and 9-13. In addition, one of the antennas, the chromatel two models are alleged to be literal infringements of claims 1, 2, 9, 10, 11, and 12. It should be noted here that while the portions of the antennas which are charged as infringing are designed solely for the reception of VHF television signals, the Isbell antenna is not so limited. It is designed both as a receiving antenna and a transmitting antenna for use in an unlimited range of frequencies. For example, the specification indicates that the antenna has very high performance characteristics over as high a range as 1100 to 1800 mc/sec.[6]

Prior Art.

Four prior patents are cited in the patent as having been considered by the patent examiners. One of these patents, five other U. S. patents not referred to by the examiners, an article published on March 31, 1958 and three antennas in use prior to 1959 are among the references relied upon by the defendant as revealing the prior art at the time of the invention. An examination of some of these references

5. The Winegard antennas that are alleged to be infringements of the Isbell patent are the models with the following numbers:

Chromaflex	B-445	R.C.A.	10-B-200
"	B-550	"	10-B-300
"	B-555	"	10-B-400
"	B-660	"	10-B-1010
"	B-770	"	10-B-1020
"	B-105	"	10-B-1030
"	B-335	"	10-B-1040
Chromatel	CT-40	"	10-B-1050
"	CT-80	"	10-B-1120
"	CT-90	"	10-B-1130
"	CT-100	"	10-B-1140

6. Isbell Patent, Col. 2, lines 47-52. See App. A.

will be helpful in defining the state of the prior art on May 3, 1960, the date of the filing of the application for the patent.

The Katzin patent (U. S. Patent No. 2,192,532, the first page of which is attached hereto as Appendix B) cited by the patent office reveals an antenna consisting of an array of dipole elements of different lengths arranged in a side-by-side relationship in a plane. While some of the illustrated embodiments of the Katzin invention show antennas having several elements of one length arranged parallel to several elements of another length, one illustrated embodiment (Figure 3c, Appendix B) shows an array described in claim 7 of the patent as being "a plurality of aerial elements, all of differing length, continuously tapering in length from one end of said antenna to the other * * *."[7] The patent also suggests, in claim 11 thereof, that the spacing between the shorter elements may be less than that between the longer elements.[8] The teaching of the Katzin patent is that if elements, or groups of elements, of differing lengths are combined into one array, each of the elements, or groups of elements, "will respond most efficiently to its corresponding band of frequencies, so that the combination of two or more such groups * * * will give the result of a high response for a wider frequency band."[9]

One of the antennas cited as prior art by the defendant is the Channel Master "K. O." antenna model 1023, produced and marketed by the Channel Master Corporation at Ellenville, N. Y. between September 1954 and December 1958. A schematic diagram of this antenna, Exhibit DX-G-16, is attached hereto as Appendix C. This antenna is an

7. U. S. Patent No. 2,192,532, p. 2, Col. 2, lines 54-58.

8. U. S. Patent No. 2,192,532, p. 3, Col. 2, lines 5-14; See also Fig. 3d, App. B.

9. U. S. Patent No. 2,192,532, p. 2, Col. 1, lines 16-21.

array of *folded* dipoles,[10] each of a different length, arranged in a coplanar side-by-side relationship decreasing in length from one end of the array to the other. The spacing between the dipole elements is irregular, the elements not being equally spaced and the spacing not varying progressively from one end of the array to the other. The feeder or transmission line running between the elements consists of two conductors, one of which is connected to the end of the folded dipole at the terminal point, the other connected to the other end of the dipole at the terminal point, and transposed between dipoles such that each conductor is alternately connected to the left and right ends of successive dipoles. Transposed feeder lines are also shown in the Koomans Patent (U. S. Patent No. 1,964,189, the first page of which is attached hereto as Appendix D) and the Winegard Patent (U. S. Patent No. 2,700,105, the first page of which is attached hereto as Appendix E), both of which are cited as prior art by the defendant. The White Patent (U. S. Patent No. 2,105,569, the first page of which is attached hereto as Appendix F) also uses transposed feeder lines in conjunction with dipole elements decreasing in length from one end of the array to the other. However,

10. Folded dipoles are simple dipoles, see n. 1, supra, which have been altered by adding another conductor in such a manner that it is approximately parallel to the simple dipole and attached to the outer ends of each half of the simple dipole. The resulting structure is an elongated loop having a terminal point midway along one of its longer sides. (See App. C) Folded dipoles have somewhat different characteristics than straight or simple dipoles, the primary differences being that folded dipoles have better performance over a greater band-width of frequencies and that folded dipoles have a greater resistance to the flow of electric current than do simple dipoles. This resistance to the flow of current is known as "impedance." In order to achieve the maximum transmission of the signal to the receiver, the impedance of the antenna, the transmission line and the receiver should be as nearly equal as possible. Television transmission line and receivers have an impedance set by FCC regulation at about 300 ohms. A simple dipole has an impedance of about 75 ohms while a folded dipole has an impedance of about 300 ohms.

the White array is "center-fed," that is, connected to the down lead transmission line which leads to the receiver, at the center of the array, rather than at the end of the array. The antennas described in the Katzin, Koomans, and Winegard patents noted above and the "K. O." antenna, as well as the Isbell antenna, are all fed at the end of the antenna having the smaller elements.

The article cited by the defendant Winegard as prior art is "Logarithmically Periodic Antenna Designs" published by R. H. DuHamel and F. R. Ore on March 31, 1958. This article explains the elements of the theory of logarithmically periodic (log periodic) antennas and the development of several such antennas. Generally stated, log periodic antennas are designed according to the theory that an antenna "design cell"[11] having high performance characteristics for reception of a limited band or period of radio frequency signals, if altered in all dimensions by a constant scale factor will have high performance characteristics for reception of a band of signals having wavelengths which vary from the wavelengths of the first band of frequencies by the same constant scale factor. Thus, according to the theory, if an antenna design cell has certain characteristics for reception of particular frequency wavelengths, an antenna geometrically similar but reduced in all dimensions by a scale factor of .5 will have similar characteristics for reception of frequencies of wavelengths half those of the first. The theory continues that if a particular design cell is reduced successively by a constant scale factor which is less than 1, and repeated periodically in one antenna "array", the array will have the characteristics of the design cell over a broader band of

11. The term "design cell" is used herein to refer to a structural unit of an antenna which is capable of receiving and transmitting electromagnetic radio energy. A simple or folded dipole and an adjacent section of transmission line are examples of such antenna design cells. A particular antenna array may be composed of one or more similar or dissimilar design cells.

frequencies which is limited only by the largest and smallest of the geometrically similar design cells which are repeated in the array. Because the performance of the antennas so designed is theoretically the same over any band of frequencies for which the antenna is designed the antennas are termed Frequency Independent Antennas. The application of this theory to antenna design appears to be limited only by the conditions that the design cell used must have uniform performance over a single period and that the overall array, the periodic repetition of the cell, not cause an "end effect"[12] that would destroy the frequency independence of the array.

The formula set out by DuHamel and Ore as defining the relationship between the repeated, or periodic, design cells is: $\tau = \frac{R_{n+1}}{R_n}$, which defines a constant proportional relationship between like elements of the design. In this case the formula relates to the radii of circular structures. Of course, in the case of geometrically similar designs all dimensions of one design are proportionally equal to all dimensions of the other similar designs. That is, they must all vary proportionally. The theory of the log periodic antenna was adopted by Isbell in his work and the formula, $\tau = \frac{L_{(n+1)}}{L_n} = \frac{\triangle S_{(n+1)}}{\triangle S_n}$ where τ is a constant having a value of less than 1, can be seen to be a simple adaptation

12. Very generally stated, "end effect" is a term used to describe a bouncing back and forth, from one end of an antenna array to the other, of any energy that is not full transmitted or absorbed by the elements of the antenna as the energy travels initially along the antenna. This bouncing, or reflection, back and forth may cause shadows or ghosts in the reception of a television picture. Thus, in order to avoid this end effect an antenna should be designed to have sufficient elements to radiate or absorb all of the energy as it passes from one end of the antenna to the other so that there will be no such reflection of the energy back down the antenna.

of the Du-Hamel-Ore formula[13] and its mathematical equivalent.

The Invalidity of the Patent

Keeping in mind the prior art previously discussed, it can be seen that an antenna with the general parameters of the Isbell Patent will result from a combination of the dipole array of Katzin with the transposed feeder line of the Channel Master "K. O." or the Koomans or Winegard Patents. Such an antenna would consist of a coplanar side-by-side array of straight dipole elements of differing lengths which decrease in length and spacing from one end of the array to the other (as disclosed by claims 7 and 11 of the Katzin patent), fed at the small end of the array by a two conductor transmission line that is transposed between successive elements (as disclosed by the Koomans and Winegard Patents and the Channel Master "K. O." antenna). Further, if the length and spacing of the dipole elements in such an antenna are adjusted by the log periodic theory of antenna design which dictates

13. While DuHamel and Ore defined circular structures by relating the radii of different parts of one cell to the radii of another, Isbell has defined linear structures by relating the lengths and spacings of one design cell to another. That these are alternative means of expressing the same mathematical relationship is evident from an examination of Figure 1 of the Isbell patent and the discussion, found in Col. 1, line 63 to Col. 2, line 2 of the patent, relative to the distance from the base line O, in Figure 1, to the dipole having the length Ln. If the distance from the base line O to dipole having the length Ln were the radius of a circle having its axis at line O and its circumference tangent to the same dipole, the distance represented by Xn ("the distance from the base line O to the dipole having the length Ln", see Col. 1, lines 71-72 of Appendix A) would be equal to Rn, where Rn is the radius of the said circle having its axis at O and its circumference tangent to the dipole of length Ln; then, it is easily seen that the formulas $\tau = \frac{Rn+1}{Rn}$ (Isbell) and $\tau = \frac{X\,(n+1)}{Xn}$ (DuHamel & Ore) are different but equal mathematical expressions of the same proportional relationship.

that the periodic or repeating cells (here a dipole element and adjoining section of transmission line) shall be geometrically similar and related to each other in size by a constant scale factor, the result is the Isbell antenna disclosure. It is thus apparent that the Isbell antenna is a combination of elements, all known in the prior art and also that these known elements were combined in the Isbell antenna in a manner dictated by a theory also known in the prior art. Therefore, the critical question is whether such a combination would have been obvious to one reasonably skilled in the art of antenna design. United States v. Adams, supra, 383 U. S. at 50-52, 86 S. Ct. 708, 15 L. Ed. 2d 572; Kell-Dot Indus., Inc. v. Graves, 361 F. 2d 25, 30 (8th Cir., 1966); American Infra-Red Radiant Co. v. Lambert Indus., Inc., supra, 360 F. 2d at 988. Those skilled in the art at the time of the Isbell application knew (1) the log periodic method of designing frequency independent antennas, (2) that antenna arrays consisting of straight dipoles with progressively varied lengths and spacings exhibit greater broad band characteristics than those consisting of dipoles of equal length and spacing and, (3) that a dipole array type antenna having elements spaced less than ½ wavelength apart could be made unidirectional in radiation pattern by transposing the feeder line between elements and feeding the array at the end of the smallest element.

It is the opinion of the Court that it would have been obvious to one ordinarily skilled in the art and wishing to design a frequency independent unidirectional antenna to combine these three old elements, all suggested by the prior art references previously discussed.[14] The test of obvious-

14. It should also be noted that the File Wrapper of the Isbell patent indicates that on November 9, 1960, all original 9 claims (final claims 1-8 and another never approved) were initially rejected by examiner G. N. Westby as being met by Katzin (Patent No. 2,192,532, App. C) in view of other patents teaching the crossing of the feeder line and the use of straight tubular conductors.

ness is the proper test to be applied in determining whether a new combination of known elements is patentable. American Infra-Red Radiant Co. v. Lambert Indus., Inc., supra, 360 F.2d at 988. When one skilled in the art with the prior art references before him could have, without the exercise of inventive faculty, combined old elements known in the art to produce the plaintiff's "invention," the "invention" does not rise to the level of patentability notwithstanding the fact that it may be an improvement over the prior art. Kell-Dot Indus., Inc. v. Graves, supra, 361 F.2d at 29. The Court, upon full consideration of the record herein, finds that the disclosure of Isbell's Patent No. 3,210,767 is lacking in the prerequisite nonobviousness and is, therefore, invalid.

Inasmuch as an invalid patent cannot be infringed Imperial Stone Cutters, Inc. v. Schwartz, supra, 370 F.2d at

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On May 10, 1961, Isbell submitted an amendment to the Patent Office wherein he argued that

> "there is certainly no teaching or suggestion in the Katzin patent of an arrangement in which *both* the length of successive dipoles *and* the spacing between said dipoles vary in a manner *such that the ratio of the length of adjacent dipoles is a constant which is also equal to the ratio of the spacings between adjacent dipoles.* Unless both of these conditions are met the antenna does not have the remarkably wide band paths, the high gain and the directivity exhibited by the antennas of the invention." (Emphasis in the original.)

Subsequently, original claims 1-8 were allowed by examiners H. K. Saalbach and Eli Lieberman as were 7 additional claims added as a result of an interference proceeding and further amendments by the applicant. It appears, thus, that the above argument in regard to the constant proportional relationship of the lengths and spacings of the elements and the importance of such relationship convinced the Patent Office that the Isbell disclosure was patentable. However, there is nothing in the file wrapper to indicate that, in ruling on the patentability of the Isbell patent, the patent examiners considered the published work of DuHamel and Ore, the formula set out therein, or the log periodic theory of antenna design all of which was a part of the prior art at the time of the application. Reference was made thereto in the interference proceedings as indicated in PX-68.

429; Kell-Dot Indus., Inc. v. Graves, supra, 361 F.2d at 28 the question of infringement is rendered moot and is, therefore, not decided by this Court.

The foregoing shall constitute the findings of fact and conclusions of law pursuant to Fed.R.Civ.P. 52(a).

It is ordered that judgment will be entered for the defendant with costs, exclusive of attorney's fees, taxed to the plaintiff.

APPENDIX A

PLAINTIFF'S EXHIBIT 31

Oct. 5, 1965 D. E. ISBELL 3,210,767

FREQUENCY INDEPENDENT UNIDIRECTIONAL ANTENNAS

Filed May 3, 1960 2 Sheets-Sheet 1

Fig. 1

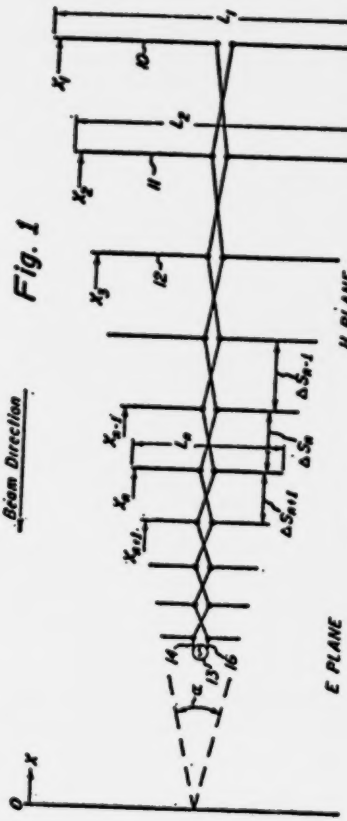


Fig. 4

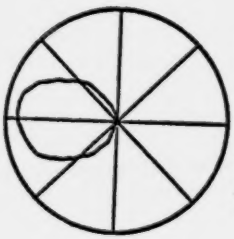
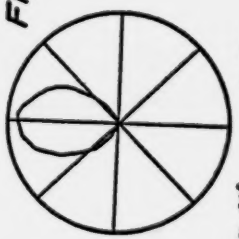


Fig. 3



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ATTORNEYS

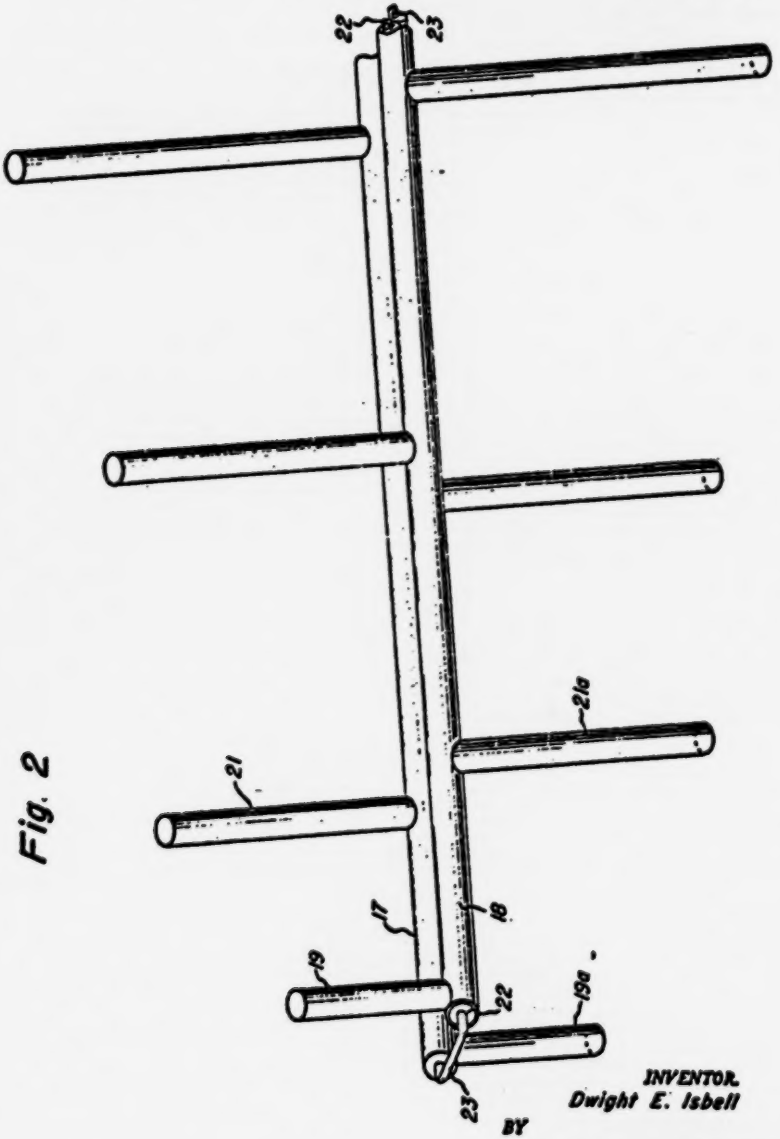
PLAINTIFFS
EXHIBIT 31
Cause No. 3-695-D Civil
Date FEB 13 1967
U. S. District Court

Oct. 5, 1965 D. E. ISBELL 3,210,767

FREQUENCY INDEPENDENT UNIDIRECTIONAL ANTENNAS

Filed May 3, 1960 2 Sheets-Sheet 2

Fig. 2



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United States Patent Office

3,210,767
Patented Oct. 5, 1965

1

3,210,767
FREQUENCY INDEPENDENT UNIDIRECTIONAL ANTENNAS

Dwight E. Isbell, Seattle, Wash., assignor to The University of Illinois Foundation, a non-profit corporation of Illinois

Filed May 3, 1960, Ser. No. 26,589
15 Claims. (Cl. 343—792.5)

This invention relates to antennas, and more particularly, it relates to antennas having unidirectional radiation patterns that are essentially independent of frequency over wide bandwidths.

The antennas of the invention are coplanar dipole arrays consisting of a number of dipoles arranged in side-by-side relationship in a plane, the length and the spacing between successive dipoles varying according to a definite mathematical formula, each of the dipoles being fed by a common feeder which introduces a phase reversal of 180° between connections to successive dipoles. The antennas of the invention provide unidirectional radiation patterns of constant beamwidth and nearly constant input impedances over any desired bandwidth.

The invention will be better understood from the following detailed description thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a schematic plan view of an antenna made in accordance with the principles of the invention;

FIGURE 2 is an isometric view of a practical antenna embodying the invention; and

FIGURES 3 and 4 are radiation patterns of a typical antenna, in the E plane and H plane, respectively.

Referring to FIGURE 1, it will be seen that the antenna of the invention was composed of a plurality of dipoles 10, 11, 12, etc., which are coplanar and in parallel, side-by-side relationship. It will be noted that the lengths of the successive dipoles and the spacing between these dipoles is such that the ends of the dipoles fall on a pair of straight lines which intersect and form an angle α. In the preferred embodiment the antenna is symmetrical about a line passing through the midpoints of the dipoles, as shown.

The antenna is fed at its narrow end from a conventional source of energy, depicted in FIGURE 1 by alternator 13, by means of a balanced feeder line consisting of conductors 14 and 16. It will be seen that the feeder lines 14 and 16 are alternated between connections to consecutive dipoles, thereby producing a phase reversal between such connections.

The lengths of the dipoles and the spacing between dipoles are related by a constant scale factor τ defined by the following equations:

$$\tau = \frac{L_{(n+1)}}{L_n} = \frac{\Delta S_{(n+1)}}{\Delta S_n}$$

where τ is a constant having a value less than 1, L_n is the length of any intermediate dipole in the array, $L_{(n+1)}$ is the length of the adjacent smaller dipole, ΔS_n is the spacing between the dipole having the length L_n and the adjacent larger dipole, and $\Delta S_{(n+1)}$ is the spacing between the dipole having the length L_n and the adjacent smaller dipole.

It will be seen from the geometry of the antennas, as given above, that the distance from the base line 0 at the vertex of the angle α to the dipoles forming the array are defined by the equation:

$$\tau = \frac{X_{(n+1)}}{X_n}$$

where X_n is the distance from the base line 0 to the dipole having the length L_n, $X_{(n+1)}$ is the corresponding distance

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from the base line to the adjacent smaller dipole, and τ has the significance previously given.

The radiation pattern of the antennas of the invention, having the geometrical relationship among the several parts as defined above, is unidirectional in the negative X direction, i.e., extending to the left from the narrow end of the antenna of FIGURE 1.

The construction of an actual antenna made in accordance with the invention is shown in FIGURE 2. In this antenna the balanced line consists of two closely-spaced and parallel electrically conducting small diameter tubes 17 and 18 to which are attached the dipoles, each of which consists of two individual dipole elements, e.g., 19 and 19a, 21 and 21a, etc. It will be noted that each of the two elements making up one dipole is connected to a different one of said conductors 17 and 18, in a direction perpendicular to the plane determined by said conductors 17 and 18. Moreover, considering either one of the conductors 17 and 18, consecutive dipole elements along the length thereof extend in opposite directions. It will be seen that this construction has the effect of alternating the phase of the connection between successive dipoles, as depicted schematically in FIGURE 1. Although the dipoles of FIGURE 2 are not precisely coplanar, differing therefrom by the distance between the parallel conductors, in practice this distance is very small so that the dipole elements are substantially coplanar and the advantages of the invention are maintained. The antenna of FIGURE 2 may be conveniently fed by means of a coaxial cable 22 positioned within conductor 18, the central conductor 23 thereof extending to and making electrical connection with conductor 17 as shown.

As an example of the invention, an antenna of the type shown in FIGURE 2 was constructed using 0.125 inch diameter tubing for the balanced line and 0.050 inch diameter wire for the elements. The elements were attached to the feeder line with soft solder, and the array was fed with miniature coaxial cable inserted through one of the balanced line conductors. The antenna was defined by the parameters $\tau = 0.95$ and $\alpha = 20°$. The antenna had a total of 15 dipoles, with the longest dipole element being 2½" long, while the shortest element was one-half of this length, or 1¼". The array was 7½" long.

Typical radiation patterns for the above-described antenna in the E plane and the H plane are shown in FIGURES 3 and 4, respectively. These patterns were found to remain essentially constant over the band of about 1100 to 1800 mc./sec. The minimum front-to-back ratio over this band was 17 db and the directivity over the range from about 1130 to 1750 mc./sec. was better than 9 db over isotropic.

The performance of the above-described antenna clearly indicates that the antennas of the invention provide excellent rotatable beams for use particularly in the HF to UHF spectrum. In comparison to the well-known parasitic types of antennas which bear some resemblance to those of the invention, such as the Yagi array, the antennas of the invention provide a much wider bandwidth with essentially comparable directivity. Advantageously, however, the antennas of the invention need no adjusting for their performance over a wide bandwidth, compared to the parasitic types which must be adjusted by cut-and-try procedures for each frequency. Further experimental work with other antennas similar to that described above has indicated that the preferred values for the parameters which define the antennas of the invention include a range of values for angle α between about 20° and 100°, with τ having a value between about 0.8 and about 0.95. When these parameters have values within the preferred ranges the antennas were

found to have essentially frequency independent performance over any desired bandwidth. The upper and lower limits of the bandwidths may be adjusted as desired by fixing the lengths of the longest dipole and the shortest dipole, respectively. It has been determined experimentally that the longest dipole element should be approximately 0.47 wavelength long at the lower limit and the shortest element should be about 0.38 wavelength long at the upper limit. Moreover, in order to provide a suitable front-to-back ratio at the low frequency limit, there should be at least 3 dipoles in the array and preferably about 10 to 30 dipoles.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

What is claimed is:

1. A broadband unidirectional antenna comprising an array of substantially coplanar and parallel dipoles of progressively increasing length and spacing in side-by-side relationship, the ratio of the lengths of any two adjacent dipoles being given by the formula

$$\frac{L_{(n+1)}}{L_n}=\tau$$

where L_n is the length of any intermediate dipole in the array, $L_{(n+1)}$ is the length of the adjacent smaller dipole and τ is a constant having a value less than 1, the spacing between said dipoles being given by the formula

$$\frac{\Delta S_{(n+1)}}{\Delta S_n}=\tau$$

where ΔS_n is the spacing between the dipole having the length L_n and the adjacent larger dipole, $\Delta S_{(n+1)}$ is the spacing between the dipole having the length L_n and the adjacent smaller dipole, and τ has the significance previously assigned, said dipoles being fed in series by a common feeder which alternates in phase between successive dipoles.

2. The array of claim 1 which is symmetrical about a line passing through the midpoint of each dipole in the array.

3. A broadband unidirectional antenna comprising an array of a plurality of substantially coplanar and parallel dipoles of progressively increasing length in side-by-side relationship, the ends of said dipoles falling on a V-shaped line forming an angle α at its vertex, the ratio of the lengths of any pair of adjacent dipoles being given by the formula

$$\frac{L_{(n+1)}}{L_n}=\tau$$

where L_n is the length of the longer dipole of the pair, $L_{(n+1)}$ is the length of the shorter dipole, and τ is a constant having a value less than 1, the dipoles in said array being fed in series by a common feeder which alternates 180° in phase between successive dipoles.

4. The antenna of claim 3 in which the angle α has a value between about 20° and 100° and the constant τ has a value between about 0.8 and 0.95.

5. The antenna of claim 3 in which said feeder is a balanced line which twists 180° between the connections to successive dipoles.

6. A broadband unidirectional antenna comprising a balanced feeder line consisting of two closely spaced, straight and parallel conductors, a plurality of dipoles each consisting of two dipole elements, one of which elements is connected to one of said conductors, the other element being connected directly opposite the first to the other of said conductors, the elements of any dipole extending in opposite directions perpendicular to the plane determined by said conductors, consecutive dipole elements on each of said conductors extending in opposite directions, the ratio of the lengths of the elements in any two adjacent dipoles being given by the formula

$$\frac{l_{(n+1)}}{l_n}=\tau$$

where l_n is the length of an element of any dipole in the antenna, $l_{(n+1)}$ is the length of an element in the adjacent smaller dipole and τ is a constant having a value less than 1, the spacing between said dipoles being given by the formula

$$\frac{\Delta S_{(n+1)}}{\Delta S_n}=\tau$$

where ΔS_n is the spacing between the dipole having the element length l_n and the adjacent larger dipole, $\Delta S_{(n+1)}$ is the spacing between the dipole having the element length l_n and the adjacent smaller dipole, and τ has the significance previously assigned.

7. The antenna of claim 6 wherein τ has a value of about 0.8 to 0.95.

8. The antenna of claim 6 wherein said feeder line conductors are tubular.

9. An aerial system including at least one set of parallel dipoles spaced along and substantially perpendicular to the longitudinal axis of a two-conductor balanced feeder to which the halves of the dipoles are connected at their inner ends, said dipoles being of different electrical lengths increasing substantially logarithmically from the connected end of the feeder to the other end and the dipole feeder connections being crossed over one another between adjacent dipoles, the spacings between which also increase substantially logarithmically from said connected end to the other end.

10. An antenna system for wide-band use comprising a plurality of substantially parallel conducting dipole elements arranged in substantially collinear pairs, the opposite dipole elements of each pair constituting dipole halves, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, each of said dipole halves in a pair being connected to a different feeder conductor, adjacent dipole elements being reversely connected to different conductors of the feeder, said dipole elements being selectively spaced along and substantially perpendicular to said feeder, the elements of each pair being of substantially equal length, adjacent dipole elements of different pairs differing in length with respect to each other by a substantially constant scale factor, the selective spacings between adjacent dipoles generally decreasing from one end of the feeder to the other with the greatest spacing being between the longest dipoles, and means to connect the feeder to an external circuit at substantially the location of the smallest of the dipole elements.

11. An antenna system for wide-band use comprising a plurality of substantially parallel conducting dipole elements arranged in substantially collinear pairs, the opposite dipole elements of each pair constituting dipole halves, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, each of said dipole halves in a pair being connected to a different feeder conductor, adjacent dipole elements being reversely connected to different conductors of the feeder, said dipole elements being selectively spaced along and substantially perpendicular to said feeder, the elements of each pair being of substantially equal length, adjacent dipole elements of different pairs differing in length with respect to each other by a substantially constant scale factor, the selective spacings between the dipoles along the feeder differing from each other also by a substantially constant scale factor, the greatest spacing being between the longest dipoles, and means to connect the feeder to an external circuit at substantially the location of the smallest of the dipoles.

12. The aerial system of claim 11 in which said scale

factors have values within the range from about 0.8 to about 0.95.

13. An antenna system for wide-band use comprising an array of at least three linear substantially parallel conducting dipoles, each dipole being composed of two opposite substantially collinear conducting elements, a two-conductor balanced feeder having one conductor connected to each of said elements at substantially the inner end thereof, adjacent parallel dipole elements being reversely connected to a different conductor of the feeder, the two elements of each dipole being of substantially equal length and successive elements being of lengths which differ from one dipole to the next by a substantially constant scale factor within the range from about 0.8 to about 0.95, the dipoles being spaced from each other in a generally decreasing manner in the direction of decreasing element length, and means to connect the feeder conductors to an external circuit at substantially the location of the smallest dipole elements.

14. An antenna system for wide-band use comprising a minimum of three pairs of linear substantially parallel conducting elements arranged substantially coplanarly, each pair being substantially collinear and comprising the halves of a dipole, a two-conductor feeder connected to the inner ends of said collinear pairs of elements, adjacent parallel elements being connected to different conductors of the feeder so that the halves of the dipoles connect to different conductors of the feeder and adjacent dipoles are reversely connected, the halves of each dipole being substantially the same length, adjacent dipole elements being selectively spaced from each other along the feeder, the length of the successive dipole elements along the feeder decreasing in accordance with a substantially constant scale factor, each dipole and the feeder between it and the adjacent dipole constituting a cell, the dimension of the several cells measured from the point of connection of one dipole and the feeder to the outer end of the next smaller adjacent dipole also decreasing from one cell to the next in the direction of decreasing dipole length according to a substantially constant scale factor so that the combination of cells provides a substantially uniform wide-band response, and means to connect an external circuit to the feeder elements at substantially the location of the shortest of the dipoles.

15. An antenna system for wide-band use comprising a minimum of three pairs of substantially parallel and coplanar linear conducting elements arranged in substantially collinear pairs, each pair of elements comprising the halves of a dipole, a two-conductor feeder, one conductor of which is connected to each of said elements substantially at the inner end thereof, adjacent parallel elements being connected to different conductors of the feeder so that the halves of the dipoles connect to different conductors of the feeder and adjacent dipoles are reversely connected, the halves of each dipole being substantially the same length, adjacent dipole elements being selectively spaced from each other along the feeder, the lengths of the elements decreasing from one end of the feeder to the other substantially in accordance with a substantially constant scale factor within the range from about 0.8 to 0.95, each dipole and the feeder between it and the adjacent dipole constituting a cell, the cell dimension from the inner end of one dipole to the outer end of the next smaller adjacent dipole also generally decreasing from one cell to the next in the direction from the longer to the shorter dipoles so that the combination of cells provides a substantially uniform wide-band response, and means to connect an external circuit to the feeder elements at substantially the location of the shortest of the dipoles.

References Cited by the Examiner

UNITED STATES PATENTS

2,192,532	3/40	Katzin	343—811
2,507,225	5/50	Scheldorf	343—814 X

FOREIGN PATENTS

1,023,498	1/58	Germany.
408,473	4/34	Great Britain.

HERMAN KARL SAALBACH, *Primary Examiner.*

GEORGE N. WESTBY, ELI LIEBERMAN, *Examiners.*

APPENDIX B

March 5, 1940. M. KATZIN 2,192,532

DIRECTIVE ANTENNA

Filed Feb. 3, 1936

Fig. 1

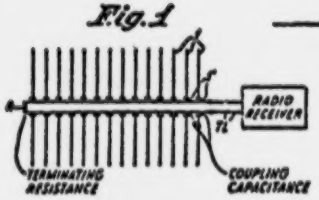


Fig. 2

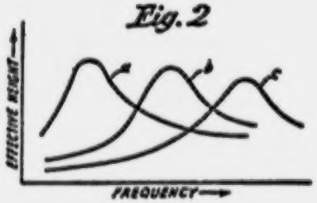


Fig. 3a

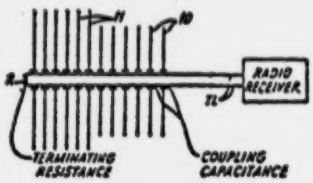


Fig. 3b

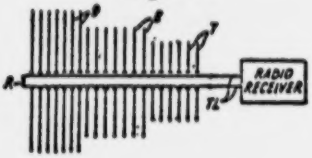


Fig. 3c

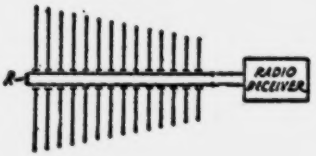


Fig. 4

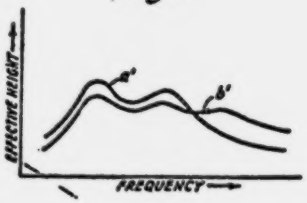
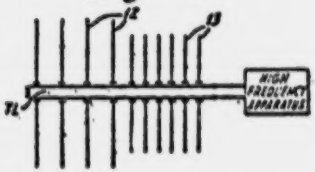


Fig. 3d



INVENTOR.
MARTIN KATZIN

BY H. B. Brown

ATTORNEY.

DX
E-4

APPENDIX C

CHANNEL MASTER
"K.O"-model 1023
FILED
FEB 17 1967
F. E. Van Alstine
Clerk, U.S. District Court
Southern District of Iowa
DX
G-16
FEB 16 1967
64⅜"
55"
71⅜"
72"
79½"
80"
87⅛"
88"
97"
98"
103¾"
103⅜"
21¾"
22"
16"
28"
22½"
22½"
20⅛"
20⅛"

APPENDIX D

June 26, 1934. N. KOOMANS 1,964,189

DIRECTIVE ANTENNA

Filed Sept. 11, 1[illegible]

Fig. 1.

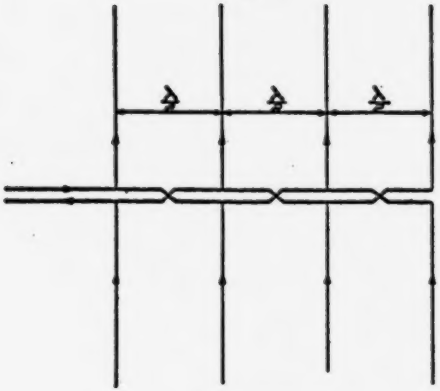
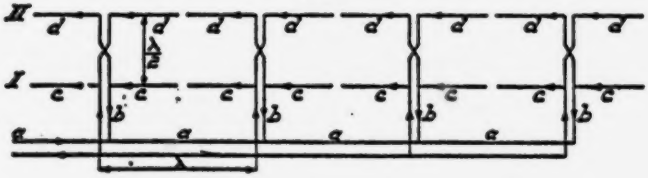


Fig. 2.



Inventor:
N. Koomans
By
Lanyon, Perry, Ward & [illegible]
Attys

DX
E-1

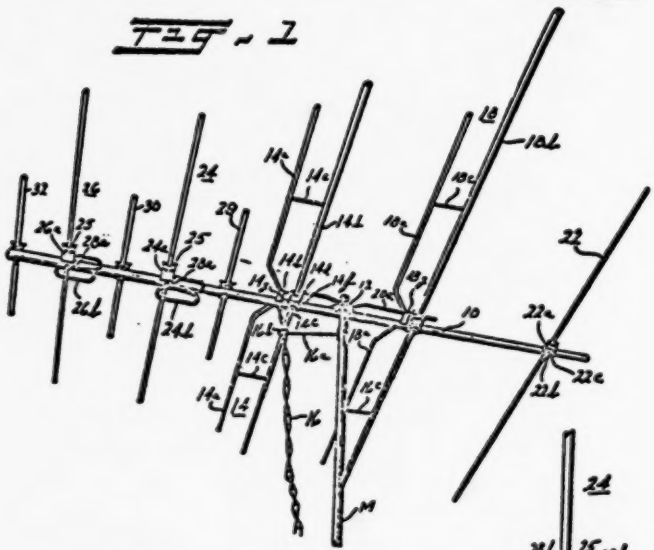
APPENDIX E

Jan. 18, 1955 J. R. WINEGARD 2,700,105

T. V. ANTENNA ARRAY

Filed July 26, 1954 2 Sheets-Sheet 1

FIG. 1



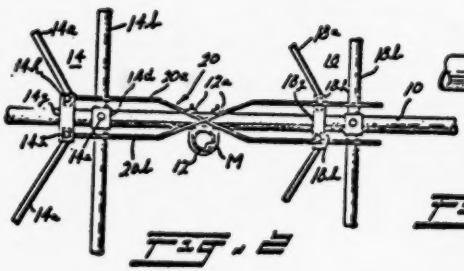


FIG. 2

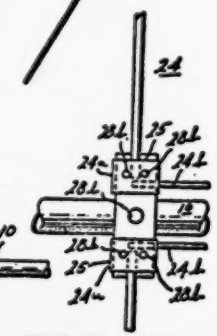


FIG. 3

INVENTOR.
John R. Winegard
BY
Bair, Freeman & Molinare
Atty's.

DX
D-1

APPENDIX F

Jan. 18, 1938. E. L. C. WHITE ET AL 2,105,569

DIRECTIONAL WIRELESS AERIAL SYSTEM

Filed April 6, 1936

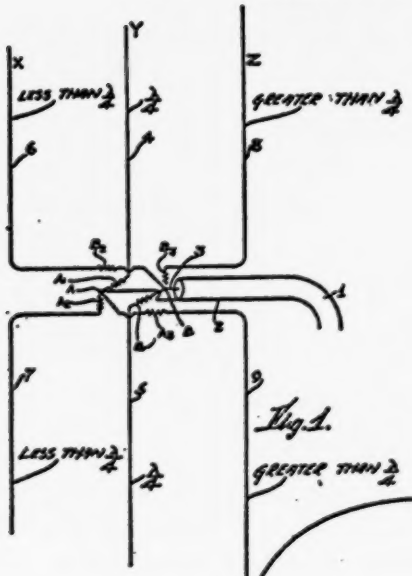


Fig. 1.

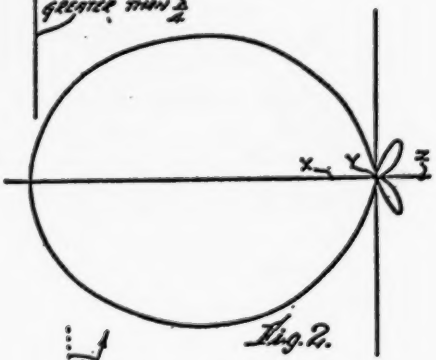


Fig. 2.

Fig. 3.

INVENTORS
E. L. C. WHITE
W. S. PERCIVAL

BY H. B. Brown,
ATTORNEY

DX
E-3

UNITED STATES DISTRICT COURT,

Northern District of Illinois,

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567 Date 5-1-67

Title of Cause—University of Illinois Foundation v. Blonder-Tongue Laboratories, Inc., et al.
Cause held on trial call until May 16, 1967 at 10 a.m.

Judge Hoffman.

May 2, 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 5-16-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.
Cause held on trial call until May 23, 1967 at 10 A. M.

Judge Hoffman.

May 17, 1967.

UNITED STATES DISTRICT COURT.

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 5-23-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause held on trial call until May 25, 1967 at 10 A. M.

Judge Hoffman.

May 23, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567 Date 5-25-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause held on trial call until May 29, 1967 at 10 A. M.

Judge Hoffman.

May 26, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 5-29-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause held on trial call until June 13, 1967 at 10 A. M.

Judge Hoffman.

May 31, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 6-13-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause held on trial call until June 16, 1967 at 10 A. M.

Judge Hoffman.

Jun 14 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 6-16-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause held on trial call until June 30, 1967 at 10 A. M.

Judge Hoffman.

Jun 19 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 6-30-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause to retain its place on calendar.

Judge Hoffman.

7/3/67.

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date Jul 18 1967.

Title of Cause University of Ill. Foundation vs. Blonder-Tongue Laboratories, Inc., et al.

On Court's motion cause placed on call of cases holding place for trial calendar No. 5.

Judge Hoffman.

Jul 18 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date August 15, 1967.

Title of Cause U. of Ill. Found. v. Blonder-Tongue Lab., et al.

On Court's motion, cause will be placed on trial call on Tuesday, September 12, 1967, at 10:00 a.m. Counsel required to be ready for trial.

Judge Hoffman.

Aug 15 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date September 11, 1967.

Title of Cause University of Illinois Foundation v. Blonder-Tongue Laboratories, Inc. v. JFD Electronics Corporation.

Brief Statement of Motion

Motion for Order Postponing Trial Date.

Notice and Motion 10/23

The rules of this court require counsel to furnish the names of all parties entitled to notice of the entry of an order and the names and addresses of their attorneys. Please do this immediately below (separate lists may be appended).

Names and Addresses of moving counsel

Merriam, Marshall, Shapiro & Klose, 30 West Monroe Street, Chicago, Illinois 60603, representing University of Illinois Foundation (Plaintiff).

Names and Addresses of other counsel entitled to notice and names of parties they represent.

Hofgren, Wegner, Allen, Stellman & McCord, 20 North Wacker Drive, Chicago, Illinois 60606 (Defendant and Counterclaimant), and

Silverman & Cass, 105 West Adams Street, Chicago, Illinois 60603 (Counterclaim Defendant).

On motion of Pltff. Cause reset from Sept. 12, 1967 and held on trial call until Oct. 23, 1967 at 10 A. M.

Judge Hoffman.

Sep 12 1967

UNITED STATES DISTRICT COURT,

Northern District of Illinois

Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date Oct. 23, 1967.

Title of Cause University of Illinois Foundation v. Blonder-Tongue Laboratories, Inc. v. JFD Electronics Corporation.

Notice

Motion

Affidavit

Brief Statement of Motion
Extension of Time.

The rules of this court require counsel to furnish the names of all parties entitled to notice of the entry of an order and the names and addresses of their attorneys. Please do this immediately below (separate lists may be appended).

Names and Addresses of moving counsel
Hofgren, Wegner, Allen, Stellman & McCord, 20 North Wacker Drive, Chicago, Illinois 60606,

Representing
Blonder-Tongue Laboratories, Inc.

Names and Addresses of other counsel entitled to notice and names of parties they represent.

Merriam, Marshall, Shapiro & Klose, Attorneys for University of Illinois Foundation, 30 West Monroe Street, Chicago, Illinois 60603.

Silverman & Cass, Attorneys for JFD Electronics Corporation, 105 West Adams Street, Chicago, Illinois 60603.

On motion of Deft., Cause held on trial call until Dec. 18, 1967 at 10 A. M.

Judge Hoffman.

Oct 24 1967

UNITED STATES DISTRICT COURT,
Northern District of Illinois
Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 12-18-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.
Cause held on trial call until Dec. 20, 1967 at 10 A. M.

Judge Hoffman.

Dec 19 1967

UNITED STATES DISTRICT COURT,
Northern District of Illinois
Eastern Division

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66 C 567. Date 12-20-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.
Cause held on trial call until Dec. 26, 1967 at 10 A. M.

Judge Hoffman.

Dec 21 1967

IN THE UNITED STATES DISTRICT COURT.
(Title Omitted in Printing)

NOTICE OF MOTION.

To: (1) Merriam, Marshall, Shapiro & Klose
30 West Monroe Street
Chicago, Illinois 60603
Attorneys for University of Illinois Foundation
and

(2) Silverman & Cass
105 West Adams Street
Chicago, Illinois 60603
Attorneys for JFD Electronics Corporation

Please Take Notice that Defendant, Blonder-Tongue Laboratories, Inc., will appear before the Honorable Julius J. Hoffman, United States District Judge, or before any other Judge who may be sitting in his stead, on Tuesday, December 26, 1967, at 10:00 A.M., to present the attached "Motion" and supporting "Affidavit".

Hofgren, Wegner, Allen, Stellman & McCord,
By Richard S. Phillips,
Attorneys for Defendant,
20 North Wacker Drive,
Chicago, Illinois 60606,
Telephone: 346-1630.

December 22, 1967.

Of Counsel:
Robert H. Rines,
David Rines,
Rines and Rines,
No. Ten Post Office Square,
Boston, Massachusetts 02109.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

MOTION.

Defendant, Blonder-Tongue Laboratories, Inc., moves that the trial of this case be rescheduled for a date no earlier than February 13, 1968.

Defendant's counsel and witnesses essential to the presentation of Defendant's case had postponed other matters anticipating a trial starting on or shortly after December 18, 1967, as set forth in the attached affidavit. These matters could not be put off indefinitely. The two principal witnesses, Dr. Lan Jen Chu and Isaac Blonder, are unavailable the week of December 26, 1967. Mr. Blonder will not be available until the first week in January and Dr. Chu is out of the country until the latter part of January. Trial counsel has a trial set for the Court of Claims in the latter part of January and will not be available after Dr. Chu's return until the first part of February.

Hofgren, Wegner, Allen, Stellman & McCord,
By Richard S. Phillips,
Attorneys for Defendant.

December 22, 1967.

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

AFFIDAVIT.

Richard S. Phillips, being sworn, says:

I am a member of the firm of Hofgren, Wegner, Allen, Stellman & McCord, local counsel for Defendant, Blonder-Tongue Laboratories, Inc., in the indicated action. The case for Blonder-Tongue has been prepared by Robert H. Rines of Boston and he will conduct the defense.

The complaint charges infringement of two patents relating to antenna structures. The answer and counterclaim asserts invalidity and non-infringement, and charges plaintiff and the third party defendant with unfair competition, violation of the antitrust laws and infringement of defendant's patent, also relating to an antenna structure.

Evidence on behalf of defendant with regard to the technical aspects of the litigation will be presented by Dr. Lan Jen Chu, one of the foremost antenna authorities in the world. Isaac Blonder, Chairman of the Board of defendant, will testify regarding Blonder-Tongue's antennas, the Blonder-Tongue patent and the unfair competition and antitrust allegations. Other witnesses from scattered points throughout the country will testify regarding the unfair competition and antitrust.

On February 20, 1967, the case was called for trial and held until May 1, 1967. Seven times since then counsel for all parties have reported ready for trial, most recently on December 18, 1967. Three times during this eight month period, it has been necessary to request special resetting, once for litigation commitments of defendant's attorney,

and once for illness of Dr. Chu. At all other times since last May, counsel and witnesses have endeavored to arrange their other business matters to accommodate the court's schedule and to be available should the case go to trial when called. On each occasion that the case was called, counsel has been advised one or two days prior to the call that witnesses should not appear.

I am informed by Mr. Rines that Dr. Chu has business interests in Taiwan, manufacturing products for shipment to the United States. Technical problems have caused a work stoppage. His presence is required to aid in the resumption of production. He delayed a trip to Taiwan in anticipation that the trial would start on the 18th of December. When we were advised that it would not start the 18th, nor the 20th, he could delay no longer and arranged to depart for Taiwan on December 25, 1967. While he is there, in addition to the business matters requiring his attention, he has appointments with several people at Taiwan National University. Dr. Chu plans to remain in Taiwan for several weeks.

I am further advised by Mr. Rines that Mr. Blonder delayed a business trip to the West Coast in anticipation of the start of the trial on December 18. When the trial did not start on the 18th or 20th, he left for the West Coast and will be there until the first week in January.

I am further advised by Mr. Rines that he had arranged other litigated matters on his schedule in anticipation of the trial starting December 18 or shortly thereafter. He presently has scheduled the following matters:

January 2, 1968: General Radio Company *vs.* Kepco, 65 CIV 90k, DCED NY, pretrial conference and motion opposing further discovery;

January 22, 1968: Chu Associates *vs.* the United States, U. S. Court of Claims, trial. Mr. Rines has been given notice for discovery in this case by the Justice Department, starting January 10, 1968;

First week in February, 1968: Evans *vs.* McDonnell Aircraft, appeal hearing, CA 8.

Richard S. Phillips.

Subscribed and sworn to before me this 22nd day of December, 1967.

Gerhardt C. Koch,
Notary Public.

(Seal)

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing.)

SUPPLEMENTAL AFFIDAVIT IN SUPPORT OF DEFENDANT-COUNTERCLAIMANT'S MOTION (TO CONTINUE, STAY OR POSTPONE TRIAL FOR 30-45 DAYS).

State of Illinois, } ss.
County of Cook. }

Before me personally appeared Robert H. Rines and deposed and said as follows:

1. My name is Robert H. Rines and I am a member of the Bar of the Commonwealth of Massachusetts, the District of Columbia and the United States Supreme Court and principal counsel for the Defendant, who has been preparing for the trial herein over a period of some nine months, including copious deposition and other discovery proceedings in various cities and states.

2. As correctly stated in the Affidavit of local counsel

Richard S. Phillips filed in support of the above motion, Defendant, with its technical expert Prof. Lan Jen Chu of Cambridge, Massachusetts, and its chief executive officer and key witness for its counterclaim, Isaac S. Blonder of Newark, New Jersey, was ready for trial on December 18, 1967, the date set by this Honorable Court. As further correctly stated in said affidavit, when this Court was unable to hold the trial on December 18, or even on December 19 or 20, and was unable to say when (or if) the trial would be held, Professor Chu and Mr. Blonder could no longer neglect their respective pressing business duties and had to depart for short business trips to Taiwan and to the West Coast and Canada, respectively.

3. While appreciating the scheduling problems of the courts, it is a fact that this same circumstance of the court being unable to meet the trial dates it previously set on several occasions, for which Defendant diligently prepared, had resulted in sudden postponements ranging from several weeks to several months and great inconvenience and loss of time for Defendant, its counsel and witnesses.

4. Without Professor Chu's presence, in view of his pre-eminent knowledge in the antenna art involved in this litigation and his copious preparation for this trial with me, I, as counsel for Defendant, am at a serious disadvantage in being forced to trial without having technical counsel during the presentation of Plaintiff's case in order to object to relevance, materiality and other matters including testimony inconsistent with the depositions, and more particularly as to cross-examination.

5. Without Mr. Blonder, the principal witness in connection with the counterclaim, including a cause involving the Blonder-Schoenfeld patent, I presently cannot prove Defendant's case, particularly since counterclaim defendant, JFD, in the midst of this litigation, deliberately hired

away co-inventor Schoenfeld from Defendant, such that the latter is now in the opposition camp.

6. My office in Boston and I personally, and Mr. Ben H. Tongue of Newark, New Jersey, another officer of the Defendant, have tried all day yesterday to reach Mr. Blonder on his West Coast-Canadian trip and have left messages everywhere we thought he might be; but as of this writing, we have not been able to find him.

7. I personally cabled Professor Chu in Taiwan yesterday as follows:

> "Judge refuses postponement. Please come as soon as possible. When? Rines";

but have received no response as yet.

8. To force Defendant to trial under these circumstances would appear to be to deprive it of due process of law, particularly when all that is asked is a 30-45 day postponement.

Robert H. Rines.

Subscribed and sworn to before me this 27th day of December, 1967.

Gerhardt C. Koch,

(Seal) *Notary Public.*

UNITED STATES DISTRICT COURT,

Northern District of Illinois,

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66-C-567. Date Dec. 26, 1967.

Title of Cause University of Illinois Foundation v. Blonder-Tongue Lab v. JFD Electronics.

Brief Statement of Motion

Move that trial be rescheduled for date no earlier than Feb. 13, 1968.

Names and Addresses of moving counsel

Hofgren, Wegner, Allen, Stellman & McCord, Richard S. Phillips.

Representing

Defendant and Counterclaimant Blonder-Tongue.

Names and Addresses of other counsel entitled to notice and names of parties they represent

Merriam, Marshall, Shapiro & Klose, Plaintiff University of Ill. Foundation.

Silverman & Cass, Counterclaim Defendant JFD Electronics.

Motion of Deft. and Counterclaimant that trial be rescheduled for a date no earlier than Feb. 13, 1968, *denied*.

Judge Hoffman.

Dec. 27, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois,

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66-C-567. Date 12-26-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories Inc., et al.

Cause held on trial call until Dec. 27, 1967 at 10 a.m.

Judge Hoffman.

Dec. 27, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois,

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66-C-567. Date 12-27-67.

Title of Cause University of Illinois Foundation v. Blonder-Tongue Laboratories v. JFD Electronics.

Brief Statement of Motion

Renewal of Motion to postpone trial.

Names and Addresses of moving counsel

Richard S. Phillips, Robert H. Rines.

Representing

Blonder-Tongue Laboratories.

Names and Addresses of other counsel entitled to notice and names of parties they represent

William Marshall, 30 W. Monroe, Chicago, University of Illinois Foundation.

Irving Silverman, 105 W. Adams, Chicago, JFD Electronics.

Motion of Defendant-Counterclaimant to postpone trial, *denied.*

Judge Hoffman.

Dec. 27, 1967.

UNITED STATES DISTRICT COURT,

Northern District of Illinois,

Eastern Division.

Name of Presiding Judge, Honorable Julius J. Hoffman.

Cause No. 66-C-567. Date 12-27-67.

Title of Cause University of Ill. Foundation v. Blonder-Tongue Laboratories, Inc., et al.

Cause continued and held for trial on Dec. 28, 1967 at 10 a.m.

Judge Hoffman.

Dec. 28, 1967.

[6] IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

Before Judge Hoffman,
December 27, 1967,
10:00 o'clock a.m.

The hearing was resumed pursuant to adjournment.

Present:

Mr. Marshall;
Mr. Phillips;
Mr. Rines;
Mr. Cass.

TRANSCRIPT OF PROCEEDINGS.

[7] (Thereupon the following further proceedings were had herein:)

The Clerk: Civil trial call. 66-C-567, University of Illinois Foundation *vs.* Blonder-Tongue, et al. Also a renewed motion, your Honor, of defendant to postpone trial.

The Court: I will hear the motion first.

Mr. Phillips: Good morning, your Honor. I am Richard Phillips, for Blonder-Tongue. I would like to introduce to the Court and move the admission for the purpose of the trial of this case of Mr. Robert H. Rines of Boston.

The Court: We will hear him.

You assure me that he is admitted to the United States District Court in Boston?

Mr. Phillips: He is admitted to the United States District Court in Boston and to practice before the Supreme Court.

The Court: I will hear you, sir.

Mr. Rines: Thank you, your Honor.

Your Honor, yesterday I understand that a motion for a postponement or stay of about thirty to forty-five days was requested. In view of the fact that the trial date set on December 18 [8] was not feasible in this Court, the two principal witnesses that are required first for the defense of the suit against our client and, second, for our counterclaim, our Professor Chu, who is the technical expert who has been working with us for a year in the preparation of this case, and, secondly, Mr. Blonder himself, who is a co-inventor of the Blonder patent involved in the counterclaim and the principal witness in the antitrust and unfair competition counterclaim.

When the 18th arrived and we in Boston received word that your Honor was not going to be able to hear the case, we pleaded with both Mr. Chu and Mr. Blonder to hold off pressing business trips because perhaps it would be heard the 19th, perhaps the 20th, perhaps the 21st. When none of these events took place, in view of the fact that this is the fifth time we were set for trial—

The Court: Are you saying that critically, sir?

Mr. Rines: No, your Honor.

The Court: I don't like to have that repeated here, Mr. Rines.

Mr. Rines: Yes, sir.

[9] The Court: I have never learned how to try cases—and I have said this repeatedly to other lawyers—by bringing witness from the airport to that witness stand. If you are an experienced lawyer admitted to the bar of the District Court in Boston, you must know that I never know, nor does any district judge know how soon the case on trial will be disposed of. It is impossible to tell. And I will say to you, sir, that I have been on trial every day here in this courtroom since the opening of the term in September and we take one after the other. This case is being tried in order as best we can. I have, as your Chi-

cago associate must have told you, a calendar in numerical order. We give it to the lawyers in July. We give them a calendar number, sir. I can't let the experts from Japan run my calendar for me.

Mr. Rines: I quite agree, your Honor.

The Court: I don't want to be charged under oath, sir, but a lawyer from Boston or a member of this bar, with depriving anybody of due process, and I am amazed, sir, that you would tender this writing to me when Mr. Hofgren of your firm is one [10] of my dearest friends at the bar, whom I have known for fifty years. To say that I would deprive—that I, by denying a motion here, would deprive a party of due process—and under oath this man made it. He has never seen me. He must know about me through you. If you hadn't told him the way we conduct this Court, you should have.

Mr. Rines: Excuse me, your Honor, may I answer that? I did not mean any offense to your Honor. You misunderstand.

The Court: Oh, I don't misunderstand. If there is one thing I can do it is read. There are some lawyers here who think I am not able to do that, but I can read. I can read this affidavit.

Mr. Rines: Your Honor, I must protect my client, too, and when there are circumstances that are beyond my control and all I am asking your Honor is for thirty days because of the fact that these two key witnesses are gone—

The Court: I will tell you that if counsel will agree, if counsel for the plaintiff will agree to this continuance, I will continue it.

Mr. Rines: I have been told on the telephone [11] that Mr. Farber, whom I spoke with, who is principal counsel for JFD, said he would agree to my motion, sir. I don't know about Mr. Marshall.

Mr. Marshall: Your Honor, I am very sympathetic with

Mr. Rines' position. I have been in the same position myself on other occasions. However, another thirty or forty days is not going to make our calendar or our program any more clear than it is today. We have our witnesses ready and we are ready to go this morning if your Honor is, and I can't join in Mr. Rines' motion. I am sorry. I apologize.

The Court: It is a non-jury case on trial here and the plaintiff has put in its case. The Government is engaged in putting in its case. Whether or not it will be finished this morning, I do not know. My view is that it will be finished so that we can try this case tomorrow, or start the trial of this case tomorrow.

This motion will be denied. The case will be held until 2:00 o'clock.

Mr. Rines: May I save my exception, if your Honor please?

[12] The Court: Did Judge Wyzansky ever tell you that there is no such thing as an exception in the United States District Court in these circumstances? Don't you know that any ruling, sir, that I make here, may be assigned as error in the United States Court of Appeals? You have the most intellectual district judge in the country, in my opinion, who heads your court there.

Mr. Rines: Yes, sir.

The Court: You don't take exception to Judge Wyzansky, do you?

Mr. Rines: I do, your Honor.

The Court: What do you say?

Mr. Rines: I do, your Honor.

The Court: And what does he state to you when you except after a ruling?

Mr. Rines: He nods, your Honor.

No, your Honor, only on something that is prejudicial to the case.

(Whereupon a continuance was taken herein until 2:00 o'clock p.m. of the same day, December 27, 1967.)

[13] IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

Before Judge Hoffman,
December 27, 1967,
2:00 o'clock p.m.

The hearing was resumed pursuant to continuance.

Present:

Mr. Marshall;
Mr. Phillips,
Mr. Rines;
Mr. Cass.

[14] The Clerk: 66 C 567, University of Illinois Foundation *vs.* Blonder-Tongue Laboratories, et al.

The Court: Gentlemen, we are still on trial here. This will have to go until tomorrow morning.

From something that was said here this morning, I think we will finish this case by tomorrow morning.

Tomorrow morning a 10:00 o'clock.

(Whereupon an adjournment was taken herein until 10:00 o'clock a.m of the following day, December 28, 1967.)

* * * * *

[1] IN THE UNITED STATES DISTRICT COURT.
* * (Caption—66-C-567) * *

Transcript of Proceedings had at the trial of the above-entitled cause before the Hon. Julius J. Hoffman, commencing on the 28th day of December, A. D. 1967, at the hour of 2:00 o'clock p.m.

* * * * *

Opening Statement on Behalf of Defendant by Mr. Rines.

* * * * *

We shall also endeavor to show your Honor that the subject matter of the claims of the two university patents was fully anticipated by the prior art.

The Court: You do more than endeavor to show. [25] You will show, so your pleading says.

Mr. Rines: Yes, your Honor.

The Court: You say the plaintiff's patents were fully, not "we believe," or "we think," or "might be shown." You say the plaintiff's patents were fully anticipated by prior art or embody only obvious differences.

Mr. Rines: Yes, your Honor.

The Court: That is what you are pleading.

Mr. Rines: We pleaded that when we knew we were going to have witnesses, your Honor. I am just hoping I can get my witnesses.

The Court: Well, I am not concerned with that. I don't start these cases. I just listen to them.

Mr. Rines: We will further show, your Honor, that in the light of the prior art any differences incorporated into the structures of these two patents were clearly obvious to the ordinary skilled worker as found by Judge Stevenson.

Further, with regard to the patent to Mayes and Carrel, your Honor, we will show that the inventors did not invent that invention, so-called [26] invention, but derived the invention from the suggestion of a member of the Air Force, so that again that patent is invalid as not having been granted to the inventor.

We will further show that the Mayes and Carrel patent, which is a reissue patent, is invalid because the reissue patent should never have been granted. The law is very strict as to under what circumstances a patent may be reissued, and we shall show your Honor that none of those circumstances existed in the present case.

We shall further demonstrate, your Honor, that the Isbell and Mayes, et al. patents are unenforceable because of the unclean hands of the Foundation and JFD, not just in connection with the acts of unfair competition and anti-trust violation, the proofs relating to which I shall cover subsequently, but because during the prosecution of the Mayes reissue patent, an affidavit was filed that presented to the Patent Office what we believe to be deceptive and misleading evidence to the effect that the earlier work of Mr. Isbell was not part of the prior art, whereupon the Examiner withdrew his rejection on Mr. Isbell and [27] issued the Mayes, et al. patent, when the fact was that the parties knew that the Isbell work was part of the prior art and had been published more than a year before the Mayes, et al. application.

In summary then, in our defense with regard to the suit brought by the University of Illinois, and in support of our counterclaim for declaratory judgment, the defendant will show that the Isbell and Mayes patents are totally invalid and void, that even had they been valid, they are unenforceable, and that in any event they have not been infringed by the defendant Blonder-Tongue.

[28] This brings us, your Honor, to Blonder-Tongue's counterclaim.

With regard to the unfair competition counterclaim, we will show that following the bringing of this suit in a clear recognition that there was no jurisdiction on our client, the University of Illinois prepared for circulation by its licensee, JFD, to the customers of Blonder-Tongue and others, a news release under the heading of the Foundation, broadcasting the fact that our client has been sued; that following this, and prior to this there has been a campaign of misleading advertisements describing the virtues of the antennas of JFD, under the name of the University of Illinois, the names of professors there, the name of the University of Illinois Foundation, leading the public and customers to believe that nobody else had a right to make a JFD antenna, falsely representing the patents in those advertisements as covering the antennas sold, when they did not, and, in general, by virtue of the joint action between the University and JFD, trying to persuade the marketplace they should not [29] buy log-periodic antennas from anybody except JFD.

The Court: Do you assure me that the evidence will reveal that the University of Illinois Foundation is guilty of distributing false advertising?

Mr. Rines: I do not say that, your Honor.

The Court: You used the word "false." When a lawyer says "false" to me, I want to look forward to it with anticipation because it makes an otherwise dull patent case an interesting one.

Mr. Rines: Your Honor, I promise you interest.

No, I say that JFD issued the false advertisement but did so using the name of the University, which it had a right to do under its agreement—not just one false advertisement but, your Honor, I will show it to you over a period of two or three years, and our evidence will also show you the admissions of JFD itself that they were false.

As if that were not enough, your Honor, our evidence

will show that after this suit was brought, and while Blonder-Tongue was trying to get JFD in as a party, JFD hired away from Blonder-[30]Tongue the man that was in charge of the whole Blonder-Tongue antenna sales program, and the very man who was then investigating for the preparation of the answer in this suit, the activities of JFD that we considered violative of the antitrust laws; and that coincident with the departure of that Blonder-Tongue key employee, all of his files, his letter correspondence files, the evidence he had collected as an employee of Blonder-Tongue, our customer sales records, disappeared.

We will further show that as late as a few months ago, when all the issues were drawn in this case, bearing in mind that the Blonder-Tongue patent in suit here is a joint invention of Mr. Blonder and one Abraham Schenfeld, this same JFD hired away from Blonder-Tongue the co-inventor, Abraham Schenfeld.

The Court: Will the proof show that your client ever sought, either in court or out of court, damages from JFD for violation of the Sherman Act?

Mr. Rines: Yes.

[31] The Court: Prior to this suit?

Mr. Rines: No, never prior.

The Court: This is the first time such a claim was asserted?

Mr. Rines: Yes, your Honor.

The Court: After you were sued, after your client was sued?

Mr. Rines: Yes, your Honor.

Might I add our evidence will also show that the antenna business was a relatively new business to Blonder-Tongue; it was just getting started. Its main business, the evidence will show, was in associated electronic equipment, not in antennas, and this was a new venture for Blonder-Tongue that we were sued on.

Our evidence will further show, as a result of these activities and as a result of whatever was said to customers by JFD, that Blonder-Tongue suffered irreparable damage from which it has never recovered yet in not being able to get in to the antenna market. Many of the acts, your Honor, which I have stated, came under the category of unfair competition and, we submit are also violations of the antitrust laws, [32] particularly since we will show that JFD, by its own admission, is the largest manufacturer of receiving television antennas in the country—perhaps the world, which brings us lastly, your Honor, to the matter of the Blonder-Schenfeld patent.

Our evidence will show that this patent describes an antenna representing a highly unobvious departure from what we admit was the prior work of the University of Illinois, pioneer work in log-periodic antennas, long preceding Isbell's patents that we are concerned with here. It was such a difference in kind, your Honor, that the Patent Office granted us a patent and the significance of it is while it isn't the greatest patent in the world, the significance is that JFD abandoned all of its prior types of antennas as taught in its own patents and copied the Blonder-Tongue structure and is using it to this day.

[33] Therefore, your Honor, our evidence will show the validity of our small patent and clear infringement by JFD.

[33] The Court: The plaintiff denies in its answer to the unfair competition and anti-trust charges that the infringement charged the patent licensor only and assert that it has played no part in designing, making or selling the antenna and that as a consequence cannot be held to have infringed your client's patent if any infringement does exist.

What will the proof show in that regard?

Mr. Rines: With regard to the plaintiff, the University

of Illinois, your Honor, the proof will show that its arrangement with JFD is more than a bare exclusive license; that it has engaged in the advertising, the selling and assisting in the selling of antennas made by JFD and, in fact, it receives money from JFD for the sale of those antennas embodying the Blonder-Tongue invention.

• • • • •

The Court: In other words, you are saying to me that the proof will show that the plaintiff-counter defendant is more than a mere patent licensor?

Mr. Rines: Precisely, sir.

• • • • •

[39] *Opening Statement on Behalf of Counterclaim Defendant by Mr. Marshall.*

Mr. Marshall: I would like to again point out I believe that Mr. Rines has made several inadvertent references to the University of Illinois. As you are well aware from the pleadings, the University of Illinois is not a party to this action; it is the Foundation.

The Court: We perhaps can all agree to call it the Foundation.

Mr. Marshall: We can agree to call it the Foundation, yes, your Honor. I believe that as a ground rule will clarify matters.

The basic problem that the Foundation has in preparing any sort of a defense to the allegations which have been pleaded in the counterclaim is the problem of trying to prove a negative.

• • • • •

Our position is that the proof will show [40] that we are merely a licensor and that we have given an exclusive license to JFD for a limited portion of the entire patent rights which we were entitled to give on behalf of the Foundation.

I am sure that we will not be able to prove from a negative standpoint that there was no unfair competition; we will merely take the position that they will not be able to prove that there was any unfair competition, that there is any patent infringement, or that there was any anti-trust violation on behalf of the Foundation.

• • • • •

[41] EDWARD F. HARRIS, a witness called by and on behalf of the plaintiff, having been first duly sworn, was examined and testified as follows:

• • • • •

[42] *Direct Examination by Mr. Marshall.*

• • • • •

[53] The evolution of the television broadcast service is a rather extensive and complex evolution, your Honor.

Up until World War II and the conclusion of the war, there was no commercial television broadcast service. However, for many, many years prior to that it was a laboratory curiosity, and in fact, large corporations expended much effort in developing the fundamentals of the field.

Shortly after World War II it was necessary for the Federal Communications Commission to recognize that a viable broadcast industry in television was coming, and it was necessary to make frequency assignments for these services.

• • • • •

[55] Q. Would you please explain to the Court, Mr. Harris, what Plaintiff's Exhibit 29 is?

A. Yes, sir. This exhibit is a total compilation of the electromagnetic spectrum, your Honor, and is quite confusing in its present form. However, I intended to extract a small portion of this spectrum and enlarge upon it in

detail as it affects or as it applies to the commercial television services. I will do that right here on the board.

Q. Perhaps you might elaborate on it a little more, to the extent of the various notations that are made on there with respect to frequency allocations, so that the Court will have a little [56] better understanding of what the electromagnetic spectrum involves.

A. I think one of the better ways of doing this, sir, is to start out with the AM broadcast service, which we have all been associated with for many, many years, namely, since the early 1920's, and the AM broadcast service occupies a portion of this chart or the spectrum running from approximately 500 kilocycles through approximately 1500 kilocycles, or one-half a megacycle, .5 megacycles, through 1.5 megacycles.

Q. Could you refer to Plaintiff's Exhibit 29 and show the Court—

A. Yes. I am having a hard time reading this chart personally, but it occurs here in the second line to the right-hand side, the black shaded portion, and continues on the third line, the left-hand side in the black shaded portion. The coding indicates that most of these black shaded portions are, indeed, assigned to commercial broadcasting services, and your Honor, this chart really depicts an important natural resource of the United States in that it is limited, and the assignments, once given, are [57] practically permanent, and so therefore the economic value and the value to the nation is important.

So the broadcast service, or the AM broadcast service evolved over the last forty years confined to this portion of the spectrum or this portion of the chart.

Q. Mr. Harris, what do you mean by cycles?

A. Cycles per second, is that what you mean, the frequency?

Q. Could you define in a more lucid manner what is

meant by cycles in terms of the frequency involved, or the type of wave involved?

A. Yes. This spectrum indication here goes all the way from 10 cycles through 100,000 megacycles, 100,000,000 cycles. This refers to the rate of vibration of an electromagnetic wave and is a portion of the electromagnetic spectrum which extends all the way from heat through radiations—radio radiations, visible light, and ultraviolet light. It is just a continuum, your Honor, of all energy that can be propagated electromagnetically or radiated through space, down as low as 10 cycles, [58] we are talking—well, between 10 and many thousands of cycles, we are talking about sound waves which can be heard by the ear.

Now, from a broadcast standpoint, we had the AM broadcast service and an FM broadcast service, which prior to World War II was assigned in the 40 to 50-megacycle range, but which now has a different assignment. This was one of the rare cases in which a decision by the FCC is changed and a whole industry is modified.

However, I will skip the FM service and go directly into the television service, and I am talking about 1940s, the middle 1940s, where the initial VHF television broadcast assignments were assigned.

Q. What do you mean by VHF, Mr. Harris?

A. Very high frequency. This is a rather loose identification which engineers use to describe a certain portion of this spectrum, and it can be pinned down to certain frequencies.

Q. Can it also be pinned down to specific channels?

A. For television.

Q. Yes.

[59] A. Yes. VHF television occupies the frequency range of 54 through 88 megacycles, and 174 to 216, and those portions of the spectrum may be found in this chart on the fourth line to the right hand—this is the 54 to 88-

megacycle range—containing television channels 2 through 6, and 174 to 216, which can be found on the fifth line, about a third of the way in from the left, and this is Channels 7 through 13. So that the original VHF broadcast service, television broadcast service, was confined to these channels.

Mr. Marshall: Your Honor, we would like to mark this as Plaintiff's Exhibit 40, for identification.

(Said document was marked Plaintiff's Exhibit 40, for identification.)

By the Witness:

A. With the advent of the VHF television broadcast service, right after World War II, most of the large population centers saw one or two television broadcast stations go into service, and in general the initial assignments were made at the low end, or the lower VHF range—in [60] other words, Channels 2 through 6, or 54 through 88 megacycles.

From an antenna designer's standpoint, the initial problem was to provide for reception of one or, at the most, two channels, and I am talking about the first year or two of the service.

Q. Prior to going into this discussion, Mr. Harris, would you explain to the Court the manner in which the television signal is transmitted?

In general, the television broadcast station or, the transmitting portion of it, transmitting antenna, is located at the center of the service area. This is a general criterion for almost any broadcast service, because you have a population center, and you have a service which tries to fill this population center as uniformly as possible with the broadcast signal.

[61] So obviously you would try to locate the TV transmitter at the center of the area.

Now obviously some areas are not circularly shaped; some are elongated, but in general this is the case, and I

think we can easily appreciate this by the knowledge of our Chicago area in that we have our various television stations and transmitters located right here near the Loop. The Prudential building is one good example; the Marina City is another good example, and, in general, these are located in the Loop area.

Therefore the television transmitter will transmit signals in all directions.

The Court: Neither one of those that you mentioned is in the so-called Loop.

Mr. Harris: No. The so-called Loop, no.

The Court: I say neither the Prudential Building nor Marina City are.

The Witness: No. They are within a short distance from the geographical center.

The Court: I just wanted you to know I was listening to you.

The Witness: The broadcast signals emanate from the center of the broadcast area. This is a general statement. There are exceptions, but this is a general [62] statement. And we have receiving sets that may be located anywhere around this broadcast area out to tens of miles and in many cases even hundreds of miles.

By Mr. Marshall:

Q. Do these signals emanate in the form of these magnetic waves you have just previously referred to?

A. Yes. For example, we have in Chicago Channel 2 and it is broadcasting in Channel 2 which is 54-60 megacycles or a six megacycle band, and this radio wave is propagated through space from the center location and intercepted by the receiving antenna. Some of the energy that is sent out in all directions impinges upon this receiving antenna and excites this antenna.

Q. Is only a single transmitting antenna used per channel?

A. Right. Each television transmitter has its own antenna and it is primarily designed to be responsive to this one six-megacycle channel.

Q. The transmitting antenna then is omnidirectional, is that correct?

A. Yes. In this case they are omni-directional and there may be literally millions of receiving [63] antennas in this area.

Q. Now in the transmission of that particular signal—say from Channel 2—what are the problems involved in connection with the receiving of the Channel 2 by a receiving antenna, a television receiving antenna?

A. In the ideal case where you might have an installation of a broadcast transmitter out in the middle of a prairie and all of your receiving antennas in a country environment where there are practically no tall structures, practically no interfering structures, the ideal case, you would have a simple path from the television transmitting antenna to the receiving antenna.

Q. Would you describe this as what is called line of sight transmission?

A. This is generally line of sight; in fact, the entire service is generally operable in line of sight which means that—

Q. Perhaps you could tell us about that.

A. Yes. The earth has a curvature and you have an antenna—this is not to scale, obviously—which is the transmitting antenna sending out a radio wave in all directions. Depending upon the [64] height of the antenna above ground, there will come a point where we hit a grazing angle where the signal now meets the earth and then goes on beyond and misses this portion of the earth. (Indicating.) This could occur anywhere from 30, 40, 50 miles out to maybe—well, in that region, 30 to 50 miles, depending upon practical heights of buildings or towers. The television

signal has some ability to follow the curvature of the earth but in general the primary zone, the primary service area of a television transmitter is the direct line of sight distance.

Now in talking about the primary service area of a television station, we must take into account the fact that because of the nature of the radio wave, because of its wave length, these are relatively short radio waves. Structures as we normally know them, buildings, tanks, signs, many, many structures will effectively reflect this wave, and therefore in the general area of a particular receiving antenna it is not only practical [65] that the direct signal from the radio station to the receiver come in a direct manner but also that many other structures such as metallic buildings and tanks, water tanks, and so forth, can and, indeed, do reflect the wave and bring it into the receiving antenna via a second path, and the effect of this is to create a second image on our television screen which the general language refers to as a ghost.

Q. What is this particular characteristic of a receiving antenna which would avoid this problem known as a ghost?

A. The receiving antenna, therefore, should have as far as possible a means of discriminating in direction; in other words, the antenna wants to be as directive as possible. It wants to receive signals only in the one direction. It wants to discriminate against other possible paths.

However, I would like to go back one step here and discuss the development of simple antennas and then get into the directive antenna.

• • • • •

[67] Q. Mr. Harris, proceeding with the discussion of the problems that occur in television transmission and receiving, you have already discussed the problem of directivity. Are there any other problems that you are aware of that

exist in the reception of television signals by receiving antennas?

A. Yes, there are. Because of this need to cover the total broadcast area, we get involved in the problem of the decreasing signal strength as you go out further and further from the transmitter, and therefore, you must have as much gain from the antenna as possible, in order to reinforce or build up the signal to the maximum extent possible from the transmitter.

Q. Would you explain what you mean by "gain", Mr. Harris?

A. Yes, gain of an antenna is a relative thing. It is a measure of the ability of the [68] antenna to increase signal strength relative to a standard—say a dipole, et cetera. However—

Q. Well, what is the desirable characteristic of the gain that is necessary? Should you have high gain, low gain—

A. You should have as high gain as possible within the reasonable structure.

Now, the problems begin to get compounded once more and more stations come on the air and more and more of the VHF channels are used. Therefore, in trying to cover all channels from 2 through 13, or this rather wide range of frequencies, the antenna designer had some early choices. It was possible, for example, to place a separate antenna aimed at a station on each channel and therefore deliver to the set signals with antennas that were optimized for each channel. Say this was Channel 2, this would be Channel 4, let's say.

Q. These are the transmitting antennas.

A. These are receiving antennas, from the central area. You have broadcast stations downtown here, and you are now located on a rooftop 20 miles away from the station, and you have both [69] channels, 2 and 4, being broadcast. Now you can dispose separate antennas for each channel,

and this indeed was done. I know of one specific example, which is Sears, Roebuck. In many of their stores, when they were demonstrating television sets in the early days, they arranged to have separate antennas cut for each channel on the rooftop and selected the antenna when they switched the set. You have a very severe problem here because you either have to run a separate transmission line down to the set, and perhaps use a switch and select the antenna for the channel.

Now, the normal television viewer has enough trouble to switch channels on his set alone and tune it in properly, let alone selecting an antenna for each channel.

Another problem, of course, occurs if you try to combine these transmission lines and feed them down through a common line, because you have a bad impedance matching problem.

Q. What do you mean by "impedance," Mr. Harris?

A. Impedance is a measure of the capability of the antenna to transfer energy from the antenna [70] to the transmission line. The best condition is when the impedance of the antenna matches the impedance of the transmission line.

Q. Why is this a particular problem so far as reception of television—

A. The major problem that can occur with an impedance mismatch is that first you do not transmit all the energy down the line, and secondly, you can create ghosts, create them within your transmission line itself.

Now, with black and white transmission, black and white television, this is not a severe problem, although it does occur. With color it can degrade the quality of the color television signal materially.

Q. Do you have any other problem so far as the reception of color television reception versus black and white,

other than what would occur perhaps in the impedance mismatching?

A. Yes. The other problem, which again is a ghosting problem, is connected with the directivity of the antenna, and this is a matter of discriminating against a second signal, which can occur due to multi-path transmission—multi-path [71] reception, I should say—and a very important characteristic of a good television receiving antenna is its directivity.

Q. You mentioned earlier that the television channel, say Channel 2, Channel 4, Channel 7, et cetera, do not broadcast on a fixed frequency, is that correct, but instead broadcast on a 6-megacycle wide band?

A. Right; right.

Q. Is that any problem that occurs as a result of this band type of broadcasting for a single channel?

A. Over a single channel, namely the 6-megacycle channel, the gain of the antenna should be as uniform as possible, simply because we do not want to accentuate any portion of the signal more favorable than other portions of the signal.

Now, in black and white again it is not a very difficult problem. In color it can affect the color distribution of the signal.

Q. What is the manifest result of this problem if you do not have a uniform gain?

A. In general you will not produce true [72] fidelity of the picture.

Q. Will there be any distortion resulting from this?

A. Yes. Certain colors might be accentuated to the detriment of other colors.

Q. Then the gain you are talking about, the uniform gain, is that the signal strength that you previously referred to, the indication of the signal strength?

A. I am referring to the gain of the antenna itself, its

ability to receive signals. It should have an ability to receive signals, with uniform gain over that channel.

[73] Mr. Marshall: Your Honor, for whatever they are worth, I have marked for identification Plaintiff's Exhibits Nos. 40, 41 and 42. These represent the several sketch pad pages upon which Mr. Harris has been discussing and explaining the rudiments of television reception.

• • • • •

Q. Would you please take the stand again, Mr. Harris?

Mr. Harris, would you please describe very briefly what experience you have had in the [74] design of antennas?

A. Yes. My experience in the design of antennas covered a period of approximately twenty-five years. It ranges from investigations of airborne antennas for military aircraft and commercial aircraft through television antenna design, commercial antenna designs for point-to-point communications, and vehicular communication antennas.

Q. What would you say would be the principal problems that are encountered by antenna design engineers in designing new antennas?

A. The major problems in designing new antennas occur once the initial theoretical—preliminary theoretical work is done and the attempt is made to reduce these designs to practice. A large amount of field experimental work must be done. It is not generally possible to predict the effects of combining various elements, predict the mutual effects of elements, and it just is not possible to do an effective antenna design job without extensive laboratory facilities.

• • • • •

[77] Q. Are you familiar with log-periodic type antennas?

A. Yes, I am.

Q. How long have you been familiar with log-periodic antennas?

A. I have been familiar with log-periodic antennas since some of the early work which occurred in the late '50s and early '60s.

Q. Have you designed and built log-periodic antennas?

A. Yes, I have.

Q. Now, would you please describe the general characteristics of log-periodic antennas?

A. Yes. A log-periodic antenna is normally—normally has a structure which consists of [78] repetitive units. These repetitive units are called cells, and each cell is similar to its neighbor, but of different size. The electrical characteristics, basic electrical characteristics, of log-periodic antennas, are relatively independent of frequency.

• • • • •

[97] Now, again, Mr. Harris, referring to Plaintiff's Exhibit No. 10, was there anything in the prior art with which you are familiar which disclosed the combination of structural components taught by the Isbell patent, Plaintiff's Exhibit No. 1?

A. Prior to Isbell?

Q. No.

Would you please repeat the question?

(The last question was read by the reporter.)

By the Witness:

A. No.

[98] By the Witness:

A. No, there wasn't.

• • • • •

[100] Q. Mr. Harris, as of the time when you first learned of the antennas which are taught by the Isbell patent, and as one who is skilled in the art of antenna design, do you have an opinion as to whether or not you would

have been able to predict the combination or to predict that the combination of structural components taught by the Isbell patent could have been made to achieve the performance of the antennas taught by the Isbell patent?

* * * * *

[102] The Court: Do you have an opinion?

The Witness: Yes, I do, sir.

[103] By Mr. Marshall:

Q. Now what is that opinion, Mr. Harris?

A. My opinion is that I would not have been able—

Mr. Fines: Objection, your Honor.

The Court: I will overrule the objection. I will let him give his opinion.

By the Witness:

A. I would not have been able to predict this particular combination at that time.

* * * * *

[137] Mr. Marshall: I have finished with the direct examination of Mr. Harris.

The Court: Is there any cross-examination?

Mr. Rines: Your Honor, would it be possible to delay the cross-examination until hopefully our expert can read the record here? We have telegraphed and cabled him again about coming here.

The Court: I don't understand you. Would it be possible to delay the cross-examination?

Mr. Rines: Delay the cross-examination until [138] he puts in his other witness on his prima facie case so our expert who is, as you know, in Taiwan has a chance to read this transcript.

The Court: Don't say that I know. I just don't know where he is and I don't know who he is except that some document was filed here. Don't put the responsibility on me, sir.

Mr. Rines: Excuse me, your Honor.

The Court: I am against conducting a case in that way. I like an orderly presentation. I am the one that is going to have to read this transcript. When I read the testimony of this witness, I want to read his direct examination and the cross-examination, so I suggest you proceed with the cross-examination of this witness.

Cross-Examination by Mr. Rines.

• • • • •

[147] Q. Now you have used the word "dipole" in your direct testimony. Would you please explain to his Honor what is the definition of a dipole.

A. A dipole is a specific type of antenna. It is generally understood to be an elementary type of antenna. It is a resonant structure usually consisting of a pair of linear components fed in the center either for transmitting or receiving.

[145] Q. Are there other kinds of dipoles besides so-called linear dipoles?

A. The linear dipole is usually considered the elementary dipole. There are other kinds of dipoles, yes.

Q. Would you tell his Honor some of the other kinds of dipoles.

A. There are dipoles such as conical dipoles in which the portions of the dipole are made up of structures which are either formed from sheets, elements of sheets such as in a conical structure. There are fat dipoles which have a rather large cross-section. Then there are other classes of dipoles such as folded dipoles.

Q. Now what are these? What do these dipoles do?

A. The dipole essentially is a transducer and it is used to couple energy from the electromatic wave in space into a transmission line which is the case for reception or to couple energy from a transmission line into free space which is the case for transmission.

Q. Would you please draw on this sheet the linear dipole, the conical dipole, the fat dipole [146] and the various types you have just referred to?

A. The elementary dipole?

Q. Please.

A. The elementary dipole consists of the two conductors as described fed in the center by a transmission line.

Q. When you spoke of linear, I presume you meant that the dipoles were extending in lines on each side of the transmission line, is that correct?

A. That is correct. Linear means line.

Q. Would you characterize—the first one you have drawn, would you number that as No. 1, please, as the simple dipole? Is that right?

A. That is the elementary dipole, yes. (Indicating.)

Q. Would you draw the conical dipole you referred to?

A. To the transmission line, the conical dipole consists of sheet cones where this is a solid figure of revolution. (Indicating.)

Q. No. 2, therefore, in the dipole you refer to are the two solid cones that you show emerging in opposite directions from the transmission line?

A. That is correct. And another form of this [147] would consist of the linear elements of the cone along the surface itself or a fraction thereof.

Q. Would you draw one of those for us?

A. (Indicating.) You could degenerate the cone into two or more individual elements of the cone.

Q. Now you mentioned also that there could be flat sheet dipoles?

A. I don't recall stating that.

Q. Is that not the fact?

A. That is possible, yes.

[148] Q. What would a flat sheet dipole look like in conical fashion?

A. Well, a flat sheet would not be a conical type antenna; it is usually referred to as a bow-tie or a flat sheet.

Q. Would you illustrate the bow-tie?

A. In this case you have a flat sheet which is normally triangular in shape, this being sold metal, again fed in the center.

The Court: You are dropping your voice. You know this is not a little conversation between you and the lawyer. It is something I must hear and this court reporter must take down. You must keep your voice up.

By the Witness:

A. These are the flat sheets, your Honor, and they are fed in the center.

By Mr. Rines:

Q. Now is it not true that these triangular flat sheets you have shown in Sketch 4, Fig. 4 may also be constructed out of wire frames?

A. This is a possible construction.

Q. Would you illustrate that as No. 5 on the second sheet.

[149] A. (Indicating.) The wire frame would outline the extremities of the sheet and then instead of this being solid, it would be an open structure.

Q. It is still a dipole?

A. It is still a dipole.

Q. How about the reverse situation that I shall draw in No. 6 where the triangles are reversed? Is that not still a dipole?

A. This structure begins to depart from the dipole in that you get rather difficult conditions existing at the feed point.

Q. When you say—the sixth there, Mr. Harris, you refer to 6, is that right?

A. Item 6. This is a section of transmission line de-

pending upon the size in terms of wave lengths; it can affect the performance of a dipole.

Q. I didn't ask you, sir, whether it affects the performance; I said it is a dipole, is it not?

A. It is a form of dipole.

Q. Are there any other forms of dipoles that are well known in this art and have been well known since the time of the Isbell and Mayes inventions?

A. I mentioned the folded dipole.

[150] Q. Would you illustrate that to his Honor?

A. (Indicating.) In the case of the folded dipole, your Honor, you begin with a standard linear dipole with its normal feed and you place an additional conductor parallel to the original conductor and tie it at its ends.

Q. Now, is it not a fact that all of the dipoles in their different forms, one, two, three, four, five, six and seven, were all well known in the art before 1958?

A. These are well known structures.

Q. Before 1958?

A. Yes.

Q. And that arrays of dipole elements, that is, pluralities of these elements placed in line were also well known before 1958?

A. Arrays of all these various dipoles were not well known.

Q. Will you tell us which ones were well known to your knowledge?

A. Primarily arrays of the simple dipole were well known.

Q. No. 1?

A. No. 1. The rest of these items 2, 3 and 4 [151] were generally used independently or as an individual element with some type of parasitic element rather than a feed array. When you say "array," I assume you mean feed elements.

Q. Yes. I am talking about a plurality of these dipoles that are connected in an antenna.

A. Would they necessarily be connected to a transmission line to be fed?

Q. Could you tell us another way to feed them?

A. There is a possibility of a parasitic excitation.

Q. So his Honor understands, what is a parasitic excitation as distinguished from a driven excitation?

A. A driven excitation occurs when two or more dipoles or elements are connected to a transmission line. A parasitic excitation occurs when a second element is brought in close proximity to the first element and by mutual effect is excited because of its proximity.

[152] Q. So that we know what we are talking about, I am concerned with antenna arrays prior to 1959, where a plurality of dipole elements are employed in the array and they are all connected to transmission lines.

Would you continue?

A. I will continue my discussion then.

As I said, Item 1 was well known, connected to transmission lines in an array.

In general Items 2 and 3 were not used in that fashion.

Item 4 was to a limited degree.

As I recall, Item 5 was the wire dipole. In this case, this is an unusual dipole. It was not generally used.

Item 6 again was not necessarily used in arrays.

Item 7 was used to a limited degree in arrays.

Q. Would you answer the same question not with regard to use but with regard to knowledge in the art? Was it known in the art that you could make arrays of these dipole elements all connected [153] to a transmission line prior to 1958?

Mr. Marshall: Your Honor, I object to that question as being very broad.

From the standpoint of what was known in the art, I

don't think Mr. Harris can speak for everybody who was in the art. I believe he can speak for himself as one skilled in the particular art, and I therefore object to the question as being too broad and speculative.

The Court: I overrule the objection. I will let him answer the question as put.

Mr. Rines: Your answer was—would you read the answer?

By the Witness:

A. My answer is "Yes."

Mr. Rines: You can sit down now.

Your Honor, I would like to offer into evidence as Defendants' Exhibit 1—

The Court: You don't offer defendants' exhibits during the presentation of the plaintiff's case.

Mr. Rines: Excuse me. For purposes of identification—

The Court: Do they do that in Boston?

Mr. Rines: I am sorry, your Honor. I thought [154] I was in direct.

I would like to offer for the purposes of identification, the first sheet—

The Court: You don't offer anything for identification; you may have it marked.

Mr. Rines: I will have it marked, please.

The Court: You are not offering it.

Mr. Rines: All right.

Defendants' Exhibit 1 is the first sheet of sketches, 1, 2, 3 and 4, and Defendants' Exhibit 2 is the second sheet, with the sketches 5, 6 and 7.

(Said sketches were marked Defendants' Exhibits 1 and 2, respectively, for identification.)

By Mr. Rines:

Q. Can you tell his Honor the name of one or more of the investigators who previous to 1958 created arrays

of dipole elements such as the one shown in sketch 1 on Defendants' Exhibit No. 1?

A. Previous to what period of time?

Q. To 1958.

A. 1958. Oh, yes.

[155] There was much earlier work done in the 1930s —for example, by investigators at Radio Corporation of America's laboratories; people such as Carter; people such as Sheldorf; later on people such as Jordan, Sinclair. There has been quite a bit of work.

Q. Now about Mr. Katzin, whom we discussed on Friday?

A. I believe Katzin had a patent in that field, an early patent.

Q. I think on your direct examination you referred to the antennas of the Isbell and Mayes and Carrel patents as frequency independent antennas.

A. Yes, I did.

Q. In simple lay language, would you give his Honor an understanding of what is the requirement of a frequency independent antenna? What is a frequency independent antenna?

A. A frequency independent antenna is one in which the basic electrical characteristics of the antenna remain essentially constant with frequency.

Q. Is another way of saying it that the [156] response of the antenna to a wide band of frequencies will be substantially the same?

A. If you define response as including several electrical characteristics such as gain, impedance match, directivity —in other words, I feel response is too broad a term.

[157] Q. Could we say that if the antenna receives the radio signals in substantially the same way, substantially the same signal strength, substantially the same directions

over the wide band of frequencies, that it is substantially frequency independent over that band?

A. Over that band of frequencies, yes.

Q. Were there not in existence prior to 1958 arrays of dipole elements that would meet that definition of being substantially frequency independent over the television bands?

A. If you use my definition of the basic electrical properties, Mr. Rines, being essentially constant, then I would say no.

Q. To your knowledge prior to 1958 there was no television antenna that produced essentially the same gain, substantially the same directivity, and presented substantially the same impedance to the transmission line over the VHF television band?

Mr. Marshall: Your Honor, I object to that question. I don't think that Mr. Rines has set up any comparison. He is talking about something in the abstract here. If he would define the [158] type of antenna that he is talking about, I think it would be easier to answer. I don't understand the question myself.

Mr. Rines: Do you understand the question?

The Court: You are not the one who has to understand it.

Mr. Marshall: I realize that, your Honor.

The Court: If the witness will say that he does not understand it, I will excuse him from answering.

The Witness: Might I ask are you talking about dipoles, arrays of dipoles?

Mr. Rines: Yes, sir.

The Witness: That was included in your question?

Mr. Rines: Yes, sir.

The Witness: I would have to answer that question and say that there was more variation over the band, over the VHF television band than would be reasonable to

classify this as a frequency independent antenna. Any antenna that I know of prior to that period had variations of the basic electrical characteristics that could not meet this definition of essentially constant.

[159] By Mr. Rines:

Q. Who made this definition of essentially constant?

A. The definition comes out of publications having to do with log-periodic antennas in general. I am not talking about log-periodic dipole arrays only; I am talking about the general class of log-periodic antennas.

Q. What publications?

A. There is a publication by Rumsey which describes much of the development of the log-periodic concepts starting from the log-periodic spirals.

Q. What definition does Rumsey give for how much variation there can be over the band and not be essentially constant or not be frequency independent?

A. There is no exact definition given for essentially constant.

Q. Do you know whether Rumsey says anything that agrees with you to the effect that the television antennas in existence prior to 1958 did not present substantially constant gain, directivity, matched impedance over the VHF television band?

A. I don't know that Rumsey made any comment [160] about television antennas in his work.

Q. Where did you get the definition you gave us a moment ago? You said it was not essentially constant within the meaning of frequency independent. Who establishes that meaning?

A. The definitions for antenna design are spelled out quite specifically in standards of the EIA.

Q. What is the EIA?

A. Electronics Industries Association. I have worked on committees preparing such standards for antennas.

[161] Q. All right. Let's take that one, if we may.

A. Yes, let's.

Q. Would you tell his Honor what is the standard put out by the EIA as to what is substantially constant, or what is substantially frequency independent?

A. I would like to continue and say a little more about the EIA standard.

Q. Excuse me.

A. For example, an EIA standard will specify voltage standing wave ratio on a transmission line in certain services. It is obvious that it is impossible to get absolute constant performance so that deviations are always allowable. However, certain specifications or certain standards become rather specific and in the case of the voltage standing wave ratio on an antenna for certain services, figures are actually published in which the various working engineers in the field can relate and can design to these standards. In certain services, for example, the voltage standing wave ratio can be specified, or is specified as a maximum of 1.5 to 1, or less, on a transmission line. [162] This would not necessarily be pinned down to television antennas, but I am bringing this background in to tell you what standard we antenna engineers refer to when we say essentially constant.

So I would say in that case an antenna with a VSWR of 1.5 to 1 would indicate an antenna which has substantially constant characteristics so long as they remain under 1.5 to 1. This I am referring to as a microwave or communication type antenna.

Q. All right. Now let's talk about the television antennas that you discussed in your direct testimony, not microwave. Will you tell us what are the standards of the EIA, or anybody else in how much you can deviate from

constant gain, constant directivity, and still have the frequency independent antenna over the VHF television band.

A. So far as I know, EIA—an EIA standard has not been written on television antennas, and I was trying to describe to you how we arrive at the concepts of constant electrical characteristics.

Q. There is no standard, then, from EIA?

[163] A. For television antennas.

Q. For television antennas.

A. But there are various standards of antenna standards in the EIA.

Q. You are confusing me now, Mr. Harris.

A. May I make it a little more clear?

Q. Please.

A. Various committees of the EIA have written standards on antennas. I was involved in the writing of the standards for the vehicular antennas. There is a standard now in existence which came into existence during 1967 and the work took about four years to prepare. It amounts almost to a consensus by the time you get finished.

As far as I know, this work has not been accomplished for television antennas.

Q. When you answered his Honor a moment ago, you would not say that this was essentially constant, that is, the prior antennas prior to 1958?

A. Yes, that is correct.

Q. What were you using as the standard?

A. I thought I had described it to you. I am drawing upon my background and my experience in antenna work, so that my interpretation of constant is based upon this type of work.

[164] Q. And would other experts disagree with you as to your interpretation?

A. I really don't know.

• • • • •

[165] By Mr. Rines:

Q. Let's see if we can establish certain things.

First of all, do you find anything in the Isbell patent, or the Mayes, et al. patent, that tells us how constant must you be to have a frequency independent antenna?

A. No, there is no absolute magnitude.

• • • • •

[168] Q. To your knowledge was Isbell the first to propose a dipole array with the antennas, where the antennas would be of changing lengths, as you have just described?

A. Was Isbell first, you say?

Q. Yes.

A. No, he was not.

Q. Were Mayes and Carrel the first?

A. No.

Q. Do you recall what investigators made such previous proposals prior to 1958?

A. I think there is some data in Katzin's patent, which shows varying size dipoles.

Q. I show you a copy of Patent 2,192,532, to Katzin, and ask you if that is the document you have reference to?

The Court: Has that been marked for identification?

Mr. Rines: It has been marked as Defendants' Exhibit No. 3, your Honor.

The Court: All right.

(Said document was marked Defendants' Exhibit 3, for identification.)

• • • • •

[170] Q. Would you agree that the Katzin Patent reveals an antenna composed of any array of dipole elements of different lengths arranged in a side-by-side relationship in a plane.

A. An array of different sized elements arranged in a side-by-side relationship in a plant. Yes; I would agree to that.

[171] Q. Would you agree that in Fig. 3-C of this Katzin Patent there is shown a plurality of these dipole elements, all of differing lengths, continuously tapering in length from one end of said antenna to the other?

A. Yes.

Q. Would you agree also that the Katzin Patent teaches that the spacing between shorter elements of this array may be less than that between longer elements? And, I refer you specifically to Fig. 3-D and to Page 3, Line 10, of Column 2.

A. Yes.

Q. Do you agree that the purpose ascribed to this in the teaching to one skilled in the art in this Katzin Patent is so that this antenna will respond to a band of frequencies so that you will get a high response for a wider frequency band than had been attainable before?

A. You say the purpose of this? I agree that the purpose of the tapering is for a wider band. However, the arrangement in this case would not produce that desirable effect.

Q. In your opinion.

A. In my opinion.

[172] Q. So far as the patentee is concerned, I call your attention to Column 1 on Page 2 of the Katzin Patent, Lines 16 to 21, and ask if this patentee is not stating, however, that he does get this wide frequency band response?

A. May I read that to be sure we have the same?

Q. Please.

A. "Reverting for a moment to the graphs of Fig. 2, it will be evident that each group of collector doublets of a particular length"—is that what you want me to read? "—will respond most efficiently to its corresponding band of frequencies so that the combination of two or more of such groups as represented by curves A, B and C will give the result of high response for a wider frequency band."

• • • • •

[174] Q. Thank you.

You previously testified in connection with the dipole that you called a folded dipole, No. 7, Defendants' Exhibit 2, and I wonder if you could tell his Honor whether there were not in existence arrays of folded dipoles prior to 1958 in which this same tapering of the lengths of the dipoles shown in Isbell Patent, Plaintiff's Exhibit 1, was in effect.

A. I believe there was one.

[175] Q. Do you remember which one it was?

A. I remember the configuration, but I don't remember the name of the patentee.

Q. I show you a sheet marked Channel Master KO, Model 1023, marked Defendants' Exhibit No. 4, for identification, and ask you if that is the configuration to which you have just been referring?

Mr. Marshall: May I see that, Mr. Harris?

By the Witness:

A. Yes, this is the array that we—

• • • • •

[177] By the Witness:

A. Is your question one of a correspondence between these dipoles and the Isbell patent, in regard to tapering?

In regard to tapering only, there is a correspondence, your Honor, but this is a significantly different dipole than is shown in the Isbell patent.

• • • • •

By Mr. Rines:

[178] Q. The Isbell patent shows the simple dipole you spoke about—

A. That's correct.

Q. —as shown in 1, Defendants' Exhibit 1, whereas this particular antenna on Defendants' Exhibit 4 is the folded element of Item 7 of Defendants' Exhibit 2?

A. That's right.

Q. Do you find any teaching in the Isbell patent, Plaintiff's Exhibit 1, or the Mayes and Carrel patent, Plaintiff's Exhibit 20, that excludes dipoles of the type shown at 7 in Defendants' Exhibit 2?

A. Yes. I would say the descriptive information, along with Fig. 1 and Fig. 2, would exclude the folded dipole in the Isbell patent.

Q. Will you point out what parts of the Isbell patent, Plaintiff's Exhibit 1, state that the dipole cannot be any kind of dipole at all?

A. I don't think that statement is made in the patent.

Q. Then I ask the question again, do you find any exclusion of a particular kind of dipole in the Isbell patent, Plaintiff's Exhibit 1?

[179] A. I see in the Isbell patent a specific kind of a dipole.

Mr. Rines: I move to strike that answer, your Honor.

The Court: It may go out as not being responsive to the question.

Mr. Rines: Would the reporter please read the question?

(Question read by the reporter.)

By the Witness:

A. Yes. There are certain dipoles which would cause this array of malfunction.

By Mr. Rines:

Q. Do you find that in the Isbell patent, Plaintiff's Exhibit 1?

A. As one skilled in the art, I see it right here when I look at the diagram, Fig. 1. I can see a case of almost a direct short across the terminals, if a particular type of dipole is used, and then this would not function as described in the Isbell patent.

Q. How about the dipole 6, would that function?

[180] A. The dipole 6 might function.

Q. And 5?

A. Yes, it might function.

Q. And 4 and 3 and 2?

A. Yes. That entire class do not have shunt elements.

Q. So, so far as that entire class is concerned, that, to you, as one skilled in the art, is within the teaching of the Isbell patent, Plaintiff's Exhibit 1, and Mayes and Carrel patent, Plaintiff's Exhibit 20.

A. My opinion is that these might function, but the Mayes and Carrel patent do not teach these particular structures.

Q. Do they exclude them?

A. No.

Q. Would you agree that prior to 1958, specifically in connection with the Channel Master KO Antenna that you have previously testified concerning, that this does, however, sow an array of folded dipoles—excuse me—that there was in existence at that time an array of folded dipoles of different lengths arranged in a co-planar, side-by-side relationship, decreasing [181] in length from one end of the array to the other?

A. Yes.

Q. Would you also agree that there was in existence in that Channel Master Antenna transposed feed between dipoles, such that each conductor is alternately connected to the left and right ends of successive dipoles?

A. In this particular—yes, this is correct.

Q. That concept of the transposed feeder, is that shown in Isbell's patent, Plaintiff's Exhibit 1?

A. Yes, it is.

Q. Would you identify for his Honor where, in Plaintiff's Exhibit 1, this crossed feeder is located?

A. It is shown in Fig. 1.

Q. It is the crossing lines—

A. This is the feeder, yes.

Q. —horizontally extending between the vertical lines.

A. That's correct.

[182] Q. You stated earlier that you knew that Isbell was not the first to make a log-periodic antenna. Could you tell his Honor who were among the first people to make log-periodic antennas?

A. Log-periodic antennas of the general class, not necessarily log-periodic dipoles?

Q. Just log-periodic antennas in general.

A. Some of the early work was done by Rumsey, who suggested many log-periodic structures, some of which did not work. DuHamel was one of the early investigators before Isbell.

Q. Did DuHamel, for example, evolve the mathematical relationships that lengths of dipoles and spacings of dipoles had to have—lengths of antenna elements and spacings of antenna elements had to have in order to be log-periodic?

A. The general class, not necessarily dipoles. You reworded your question, is that correct?

Q. Yes, just antennas in general.

A. The general antenna elements or portions thereof of the antenna. I think much of the early mathematics was done by Rumsey and DuHamel as his student.

[183] Q. You, on direct examination, talked about Tau, a Greek letter, which appears, for example, I think you testified, in column 1, line 55, of the Isbell patent, Plaintiff's Exhibit 1. Did that Tau originate with Isbell?

A. No.

Q. Do you know who did evolve that relationship?

A. The Tau factor is a general factor which is used throughout the log-periodic art, so it would go back before Isbell.

Q. And that mathematics then was evolved before—

A. Yes, but this particular Tau, referring to length of

elements and length of spacings as applied to the log-periodic dipole array, did originate with Isbell.

Q. How do you know that?

A. I know this from all the antenna art, consisting of publications and general information in the field, that I have absorbed during this period of time. The first time I have ever seen—I have ever seen Tau referred to in this specific [184] relationship, was in publications having to do with Isbell.

Q. I think you said a moment ago that Tau, for spacing between successive antenna elements, was new with Isbell.

A. This is in the log-periodic dipole array you are talking about.

Q. So his Honor understands, is that correct—there have been previous log-periodic arrays you are talking about—

A. Configurations far different from dipoles.

Q. The point that you are bringing out is that Mr. Isbell concerned himself with antennas of the type shown at 1, as distinguished from other investigators of other types of antennas, is that correct?

A. That's correct.

Q. In connection with those other types of antennas, is it not true that Rumsey and DuHamel taught a Tau of spacing between the elements of the other types of antennas that was precisely this Tau?

[185] A. The other types of antennas you referred to, I assume, of the Rumsey and DuHamel antennas, as they developed earlier—

Q. Yes.

A. —and I don't recall them having discrete elements.

Q. You don't?

A. They had planar structures, they had spirals, they had—the sections of the antennas that were scaled from

other sections, as I described earlier, to be a basic consideration in the log-periodic structure, but they did not have dipole elements as such.

Q. Then you are unaware, for example, that DuHamel proposed wire triangular dipoles as shown in 6, Defendants' Exhibit No. 2?

A. I would not interpret DuHamel's proposal as wire dipole elements, and I don't recall any where Mr. DuHamel stated that these were wire dipole elements. He may have stated, talked about zigzag elements and portions of a solid structure outlined by wires, but did not call them wire dipole elements.

[186] Q. Are you aware that DuHamel made arrays of these zigzag structures that ended up in triangular elements extending from each side of the line, as shown at 6, Defendants' Exhibit 2, prior to Isbell?

A. They did not extend in his structure as they are depicted in 6.

Q. Will you please step down and show us how they did extend?

A. DuHamel's structure was not a co-planar structure.

Q. Could you stop just a minute to explain to his Honor what does "co-planar" mean?

A. "Co-planar" means that all the elements that constitute the antenna are essentially in the same plane.

Now, DuHamel began from a feed point and constructed elements that would zigzag in such a fashion that they would taper and also would taper at an angle. It is a little difficult to show this in perspective here, but these elements were not dipoles in the effect that one-half of one was exactly opposite one-half of the other. In fact, in many cases they interleafed or [187] closed upon each other.

• • • • •

[196] Q. You spoke a little earlier about the co-planar nature of the arrays of Isbell's Patent, Plaintiff's Exhibit 1,

and you used the words, "it meant that the antennas were essentially in the same plane." How close to the same plane is "essentially"?

A. This is a matter that is involved with the frequency of the antenna, its application, and is involved with a percentage of a wave length. There are many factors that bear on this word "essentially.' However, as compared to the work that DuHamel teaches [197] or his articles, where he specifically states non-planar, DuHamels work was non-planar.

Q. And the non-planar work of DuHamel preceded Isbell and Mayes and Carrel, to your knowledge.

A. That's correct.

• • • • •

[201] Q. Will you tell us, from your reading of the Isbell Patent, what it teaches as to the desirability—

The Court: That is the way to ask it.

By Mr. Rines:

Q. —of co-planar operation?

The Court: That is the way to ask the question.

By the Witness:

A. From the reading of the patent it teaches one skilled in the art how to design an antenna of this type, and there are interdependent relationships here so that you cannot disregard one for the other, and in designing this type of antenna, you must design a feeder structure as well as a dipole element, so that obviously from reading the figures, especially Fig. 2, you can see that there is a deviation from co-planar which is specific and is determined essentially by the structure of the feeders.

[202] Q. What kind of feeders are used in Fig. 2?

A. The feeders used here are parallel wire transmission lines.

Q. What is used to feed them?

A. The excitation of the feeders, in this particular case the excitation takes place at the front end through an additional transmission line which is brought internally through one of the feeder conductors.

Q. Is that the coaxial lines 22, 23 in Fig. 2?

A. Yes. This is a coaxial transmission line.

Q. How close does Fig. 2 show the dipoles 21 and 21-A?

Mr. Marshall: In terms of inches, Mr. Rines, or close in what regard?

Mr. Rines: Whatever the expert teaches.

By the Witness:

A. It doesn't show. This is a pictorial representation.

• • • • •

By Mr. Rines:

[202] Q. To one skilled in the art, what teaching of Isbell do you follow in determining how close these must be from the Isbell Patent?

A. The closeness of 21 and 21-A is determined [203] by the spacing of the feeder.

Q. And what does the Isbell Patent teach about the spacing of the feeder?

A. The spacing of the feeder is essentially small. I think he uses the word "small" in the text here.

Q. He says "very small," doesn't he?

A. I am not reading it.

"In practice,' it says, "this distance is very small so that the dipole elements are substantially co-planar."

Q. Are you aware that in order to compensate for this small distance, these original antennas that you say you learned about in '59 and '60 even have the dipoles bent downward to be in the same plane because there structures were very small distances apart?

A. I have seen that type of structure used.

• • • • •

[204] Q. Would you agree that those skilled in the art at the time of the filing of the Isbell application for the

Isbell Patent, Plaintiff's Exhibit 1, knew the log-periodic method of designing frequency independent antennas?

The Court: I will let him answer.

By the Witness:

A. The general principle of log-periodicity [205] was known.

Mr. Rines: May I have an answer to my question, your Honor?

The Court: The witness but—you move to strike the answer?

Mr. Rines: I move to strike it.

The Court: If you do, I will allow the motion. I strike the answer as not being responsive.

Miss Reporter, please read the question to the witness.

(Question read.)

By the Witness:

A. For the general class of log-periodic frequency independent antennas, the answer would be yes.

By Mr. Rines:

Q. Would you agree that those skilled in the art at the time the Isbell application for the patent, Plaintiff's Exhibit 1, was filed knew that antenna arrays consisting of straight dipoles with progressively varied lengths and spacings exhibit greater broad band characteristics than those consisting of dipoles of equal length and spacings?

A. I would not agree to that, not generally.

[206] Q. Was it known?

A. It was not generally known.

Q. Was it known not generally to those skilled to anyone skilled in the art prior to that?

A. That automatically using variable spacing and variable lengths would automatically produce broad band—is that what you are asking?

Q. That progressively varying lengths and spacings would exhibit greater broad band characteristics than the same dipoles of the same length and spacing?

A. Well, there were some examples, some specific examples of that, and there were specific examples of that principle producing narrower band width.

Q. Were there examples before Isbell's invention resulting in Plaintiff's Exhibit 1 of progressively varying lengths and spacings that did exhibit broader band characteristics than dipoles of equal lengths and spacings?

A. I would say that there were examples of slightly increased broad band performance.

Q. Would those skilled in the art at the time of the application for the Isbell Patent, [207] Plaintiff's Exhibit 1, know—did they not know that a dipole array type antenna having elements spaced less than a half wavelength apart could be made unidirectional in radiation pattern by transposing the feeder line between elements and feeding the array at the end of the smallest element?

A. Yes, there were cases.

• • • • •

[220] Q. I asked you if you knew, Mr. Harris, whether in the practice of this invention what the spaces were, how much were the spacings between elements 17 and 18.

A. I am trying to tell you how we do this in practice.

Q. Do you know in inches, for example?

A. It would depend on the transmission line impedance that you want to create. Now if you want to give me the value of impendance, I can give you a general statement of the size in inches.

[221] Q. Can you tell his Honor what the impedance is in the antenna taught in Fig. 2 of the Isbell patent?

A. I don't know. It could vary. If it is fed by coaxial cable I would think that you would wish to match the coaxial cable to the antenna, and therefore the impedance

would be a relatively low impedance, as we determine it in antenna design, but coaxial cable impedances can vary anywhere from tens of ohms to several hundred ohms.

• • • • •

[222] Q. Would you add to sketches 1 through 7, Defendants' Exhibit 1 and 2, a diagram showing the current or voltage distribution on those dipoles, assuming they are equivalent?

[223] A. On these dipoles?

Mr. Marshall: Your Honor, I again object, only from the standpoint that this is going into the background aspect, and I don't believe it is relevant from that standpoint.

The Court: Point out the relevancy, please.

Mr. Rines: Yes, your Honor.

In direct testimony Mr. Harris talked about the dipoles, and discussed these very dipole elements of the type shown in 1, in connection with these antennas, and talked about the voltage and current on those, and I am asking him, if your Honor please, if he would show with a diagram, how the voltage and current appears on those dipoles.

The Court: I will let him answer.

By the Witness:

A. I would draw the current distribution.

By Mr. Rines:

Q. Thank you.

A. This would represent the current distribution on a sample dipole. It is somewhat simpler.

Mr. Marshall: Mr. Harris, would you please speak a little louder and more directly?

[224] By the Witness:

A. This is a current distribution on a sample dipole. These become somewhat more complicated but I will give

the simplified version, drawing a current distribution in this fashion.

The current is maximum at the center and generally close to zero at the end.

This particular configuration I have not studied very thoroughly myself, and I don't know exactly what the current distribution would be with this type of center feed point, but in general it would follow the general outline of this distribution, and the folded dipole has this center distribution.

By Mr. Rines:

Q. Would it be a fair statement that all of those dipoles operate to receive, for example, radio energy in substantially the same way, but they differ by their impedance characteristics?

A. Yes, that is basically true.

• • • • •

[225] *Redirect Examination by Mr. Marshall.*

Q. Mr. Harris, this morning on cross-examination you were testifying concerning certain generalized statements.

Now I would like to ask you whether or not you know as one skilled in the art as an antenna designer, whether or not there is a so-called log-periodic method of designing frequency independent antennas.

[226] A. There is no such generalized method as a log-periodic method of designing a general class of antennas. There are log-periodic structures as such, and there is a generalized method for determining whether a structure is a log-periodic structure, but whether it will work as a practical antenna or not cannot be predicted on that basis.

Q. Are you familiar with the text book designated as "Antenna Engineering Handbook" by Jasik?

A. Yes, I am a contributing author.

The Court: You didn't finish your sentence.

The Witness: Yes, I am familiar with it.

The Court: You said you were a contributing what, editor?

The Witness: No, author.

By Mr. Marshall:

Q. Are you familiar with the chapter in Jasik which is entitled "Frequency Independent Antennas," which is Chapter 18, starting at Page 18-1?

A. I believe that chapter was written by DuHamel.

Mr. Marshall: Your Honor, for the record, I am reading from Jasik's "Antenna Engineering Handbook" Chapter 18 entitled "Frequency Independent Antennas, [227] George S. A. Deschamps, University of Illinois Electrical Engineering Research Laboratory, Urbana, Illinois and Raymond H. DuHamel, Collins Radio Company, Cedar Rapids, Iowa.'

That is the identification, your Honor. The chapter starts at 18-1, and apparently this pagination system is by chapter as opposed to a numerical sequence.

The Witness: Should I answer—

By Mr. Marshall:

Q. Mr. Harris, I refer you to Page 18-13 and request that you read the next to the last paragraph on 18-13.

Mr. Rines: Is this being offered in evidence?

The Court: It is evidence because the witness is being asked to read it. Do you object?

Mr. Rines: No, your Honor.

The Court: All right. It is evidence, nothing else. I don't know what else it can be, if a witness is asked to read from some book. He may do it. You may go ahead and read, with no objection.

By the Witness:

A. "It should be pointed out that many types of log-periodic structures are not broad band because [228] of either extreme variation over a period or severe end effect, which destroys the periodicity of the electrical characteristics. Only the successful structures are described herein. Unfortunately it is not possible to determine a priori the frequency independent types of log-periodic antennas."

By Mr. Marshall:

Q. Now, Mr. Harris, as one who is skilled in the art of antenna design, do you agree with that statement?

A. Yes, I do.

• • • • •

Q. Mr. Harris, do you know of any structures which conform with the log-periodic principle of repetitive cells, which do not function as antennas?

A. Yes, I do.

• • • • •

[230] Q. Now, Mr. Harris, as one who is skilled in the art of antenna designs, is there a generalized and widely applicable theory which states that antenna arrays consisting of straight dipoles with progressively varied lengths and spacings exhibit greater broad band characteristics than those consisting of dipoles of equal length and spacings?

A. No, there is no such general rule.

• • • • •

[233] Q. Mr. Harris, referring to Plaintiff's Exhibit 1 again, is there any teaching in the Isbell patent which teaches you that the other types of dipole elements which were illustrated by you this morning, following No. 1, sketch No. 1, can be used as the dipole elements in the antennas which are taught by Isbell Patent 3,210,767?

A. No, there is no teaching in the patent that indicates that type of—these types of elements.

• • • • •

[234] *Recross Examination by Mr. Rines.*

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[236] Q. I would like to ask you whether, on Page 18-13, you would read the first complete paragraph.

A. Beginning with "A recent"?

Q. Yes, sir.

A. "A recent and rather simple type of [237] log-periodic antenna is illustrated in Fig. 18-11."

Q. Could you pause there a moment? Would it be fair to say that that is the antenna shown in the Isbell Patent, Plaintiff's Exhibit 1?

A. That would be equivalent to Fig. 1 of the Exhibit No. 1.

Q. Thank you. Please continue.

A. "It consists of an array of dipoles with lengths and spacings arranged in a log-periodic manner. The dipoles are excited by a uniform two-wire line with the line transposed between adjacent dipoles. The antenna may be fed with a balanced line connected to the feed point or a coaxial line entering from the right and passing through and inside one of the balance lines of the feel point. It may be noticed that this antenna may be derived from that of Fig. 18-9 by letting the tooth width and the angle beta approach zero and then folding the two half structures about the horizontal axis so that the angle psi approaches zero."

Q. That last reference as to how you derived this log-periodic antenna referred to Fig. 18-9. It is correct to state that Fig. 18-9 is the prior [238] type of log-periodic antennas of DuHamel that you spoke about earlier today?

A. Yes; this would be the tooth structure of DuHamel.

Q. What that phrase says to one skilled in the art is, you make the tooth smaller, and you make the center angle smaller—

A. It doesn't say that. It says it may be derived. I don't know how they have derived it, but it might be derived in that fashion.

Q. Are they not saying here that they can derive Isbell's antenna by taking the prior art antenna and making the tooth smaller and the angle go to zero?

A. I didn't read that.

Q. Would you tell me what they are saying then?

A. It said that it may be noticed that this angle may be derived by letting the tooth width and the angle beta approach zero.

I have to change that. Yes, this is what it states.

[239] *Redirect Examination by Mr. Marshall.*

Q. Mr. Harris, would you read for the record the date that appears on the frontispiece of the "Antenna Engineering Handbook"?

A. McGraw-Hill Book Company, Inc.; 1961 is the date.

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[254] *Colloquy.*

Mr. Marshall: Plaintiff rests, your Honor.

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[255] Mr. Rines: To the contrary, your Honor, I would like to move to dismiss on the following grounds.

It is true, your Honor, that a patent has attached to it a presumption of validity, and there can be no question but that copies of the patent have been put in evidence, and we have stipulated it need not be the original patent.

Part of the burden of the plaintiff, however, is to prove infringement. And this is his burden, he must prove infringement.

Now in this record, viewed in its most favorable light, there has not been one single word or mention of a single claim of either or the patents, or the combination of elements from a technical point of view that are recited in a single claim, or an application of all of the technical elements of a single claim to the defendant's structures, to that facts are available to your Honor to illustrate that all of the [256] elements of a claim are technically met, as distinguished from a legal conclusion that follows there is an infringement.

I would like, if I might, your Honor please, briefly to review what has been said in the record to show you that we feel that the law supports us that this falls short of a prima facie proof of infringement.

For example on Page 94 of his testimony Mr. Harris was asked the question, "Does this antenna, the Golden Dart antenna"—that is Mr. Blonder's antenna here, Exhibit 10, "have the same structural components as the antennas taught to those skilled in the art by the Isbell Patent, Plaintiff's Exhibit No. 1?"

Notice, your Honor, it does not say "the same structural components set forth in the claims of the patent." It merely says "the same structural components as the antennas taught in the patent."

Now, Walker on Patents, and the law following him on which he based his summary of the law of patents made it clear, and I quote from 1681, under the section of infringement of Walker on Patents, Page 1681, "The patented [257] invention is not everything disclosed within the four corners of the patent. For many ideas for concepts are disclosed and suggested by the specifications and drawings which are not protected by the patent.

Strictly speaking an infringement of a patent is erroneous. What is infringed are the claims of the patent which measures the invention and define precisely what the in-

vention is, and the limits beyond which one cannot pass without infringement.

Therefore it is to the claims of the patent to which one must look to determine whether there is infringement."

Citing the Continental Paper Bag, the Eastern Paper Bag 210 U. S. 405, and a whole host of additional cases. [258] Thus, it is the practice in the prosecution of patent cases to call an expert, not for the purpose of doing what you Honor does, namely to determine the matter of patent infringement, but to lay a factual basis that at least in Claim 1 or Claim 2, or whatever it may be, there are a group of elements recited, and technically these elements find their response in the defendants' products, by this, this, and this.

On the basis of that proof of facts your Honor concludes what their claim means and whether there is infringement.

As to this, there has not been one word of testimony or of proof.

The Court: May I interrupt to ask a question with respect to the Weingard case?

Mr. Rines: Yes, your Honor.

The Court: Was that case decided by Judge Stevenson?

Mr. Rines: Yes.

The Court: On a motion to dismiss?

Mr. Rines: No, your Honor, that was a case where more than one witness was presented by the plaintiff, too, and there was no such short record [259] as there is here, your Honor.

That was the only question that was asked with regard to the Color Ranger antenna, the same thing. Nothing tying in with the combinations of the claim. No facts on which your Honor could conclude yes, that a technical man has said all these technical elements are here, I see them tied into Claim 1, and I will decide the scope of Claim 1 in the matter of infringement. Nothing to aid your Honor at all.

The second point is, looking at the testimony most favorably to the plaintiff, if your Honor will observe for example, Claim 1 alone of the Isbell patent, Plaintiff's Exhibit 1, Claim 1 starts out, your Honor, in line 2, talking about an array of substantial co-planar and parallel dipoles. Claim 1 in column 3, the second line of the claim, in line 19, calls for an array of substantially co-planar parallel dipoles.

There has not been a single word of testimony, your Honor, to let your Honor know whether, in any of these defendants' structures, there is such a thing as co-planar, or whether in fact there is more than one plane. Not even the [260] technical facts, your Honor, as to what the co-planar means, means to one skilled in the art, and whether a structure is found in the defendants' antenna, that responds to co-planar.

Without a factual, technical basis, therefore, I will maintain that the plaintiff has fallen woefully short of proving the facts of what is in the claims, as distinguished from the patent, which describes prior art in it too, so that your Honor may draw the legal conclusion that a claim is infringed.

There is, however, in fairness to the other side, a line of questioning that apparently was intended to give a legal conclusion, or give you the basis that there was infringement without going into the necessity of showing you that a single claim had all the elements responding in the defendants' structure.

And that appears, for example, on page 116 of the testimony, where the question was asked:

> "Now, does this antenna, namely the Color Ranger, Plaintiff's Exhibit 35, function in the same manner to give [261] you the same result as the antennas taught by the Isbell patent, Exhibit No. 1?"

Now, as a matter of law, your Honor, not all things that function in the same manner are legal equivalents.

Therefore, just that opinion question, without any testimony to explain what are the elements of the claim that operate in the same manner to produce the same result, but merely to say the overall things give the same results, falls again far short, particularly when it is unsupported, an unsupported statement of opinion without any factual basis, for this Court to make any specific finding that a particular claim is or is not infringed.

As a matter of fact, your Honor, what claims are there that are alleged to be infringed? Not a single number has been told. Are they all the claims of all the patents? They are clearly not.

[262] May I, your Honor, invite your attention to a couple of cases that we think points out this fatal defect in the proof. We have not had much time to research this, as your Honor may well imagine.

The Court: I will not agree with that last statement that you have not had time to research. This is one of the oldest cases on my calendar. You have had time to do all the research that is necessary in this case. You do the imagining, I don't imagine.

Mr. Rines: Excuse me, your Honor. May I make an observation, your Honor. We were informed that there was going to be more than one witness and not until this morning at intermission did we know differently.

The Court: Well, I don't have to imagine that. I was told myself by—I don't want to trust my recollection, but certainly somebody for the plaintiff told me that it would take much longer than two sessions of my time.

Mr. Marshall: I think we said two days, your Honor.

The Court: I am not critical. I am grateful. [263] I have gotten to a point in my career where I don't care how I decide them as long as I decide them correctly. If it

takes only a day and a half to present a plaintiff's case it is a relief.

In the event I decide not to allow your motion at this time I hope you do as well by me.

Mr. Rines: In American Technical Machinery Corporation *vs.* Caparotta, in the Second Court of Appeals, 1964, 339 F. 2d 557, the Court pointed out that it was the defendant and his expert who testified that all of Marks claimed in the suit could be read on the bricklayer machine.

This is the kind of testimony and evidence that is then required for the judge to make a legal conclusion which is purely the Court's in the matter of infringement.

In that case on Page 116 the judge had drawn the wrong legal conclusion as to infringement and scope of the claims, and the Court corrected it. But it did make a point that the expert testimony brought out what were the claims and the fact that all the elements of those claims did respond [264] to the machine of the other side, element for element.

Another case in the Court of Appeals of the Eighth Circuit in 1961, your Honor, Parmalee Pharmaceutical Company *vs.* Zink, 285 F. 2d 465, again reiterates the point of law that I quoted from Walker, namely that "In determining whether"—I am quoting "In determining whether an accused product infringes a patent 'resort must be had in the first instance to the words of the claim'."

That last quote was from the recent Supreme Court decision, Graver Manufacturing Company *vs.* Linde, 339 U. S. 605, 607.

What words of a claim, your Honor, were presented factually to you and shown to have a technical response in any of the accused structures, so that your Honor could then make a legal conclusion with regard to the matter of infringement?

The Court: I think you are entitled to an answer. I won't let that question remain rhetorical.

Have you finished your argument in support of your motion?

Mr. Rines: Yes, your Honor.

The Court: I ask you to reply, Mr. Marshall.

[265] Mr. Marshall: Your Honor, perhaps esteemed counsel from Boston adopts the attitude that this is the way a patent case should be tried, where one has an expert appear before the Court and by rote goes over a preplanned and prearranged argument, which is nothing more than the expert is giving, as to what is the correspondence between the patent in suit and the infringing device.

The Court: Not in this Court.

Mr. Marshall: Not in this Court.

The Court: The witness does not argue. If they start to argue we stop them without objection. You are mistaken about that, Mr. Marshall.

Mr. Marshall: I am sure that this is the problem with most patent cases, is that the courts, this Court being the exception, are inclined to let an expert get up there and act as junior grade counsel for the one who is trying the case.

Your Honor, our philosophy in our office has been that we as the lawyers, are going to do the arguing. We are not going to call upon any expert, who obviously is being paid and obviously is on our side, to read correspondence between the [266] infringing device and the claims of the patent.

The Court: What I would ask you to do is to get to the point raised by Mr. Rines, with respect to the claims and how they read on the accused devices here.

Mr. Marshall: Your Honor, I think that again—

The Court: That is his main point.

Mr. Marshall: I think that is the responsibility of the courts. As Mr. Merriam has frequently told me, that Judge Lindsay told him one time in response to a question

of this nature, the Judge said, "Don't you assume that I know how to read?"

And I assume this is the instance here, your Honor. We are not laboring under any misapprehension, this Court clearly can read the claims in the case as well as anybody who is in this courtroom.

The Court: Are you saying to me then that counsel is mistaken, that as a matter of the law and evidence it is not necessary, as a matter of law, to have such testimony as he argues should be included in the plaintiff's prima facie case?

Mr. Marshall: That is exactly what I am [267] saying, your Honor.

And if I may quote from the Kohn *vs.* Eimer case, and it is 265 F. Rep., 902, and the case starts at 900,—and this, your Honor, is a Judge Learned Hand decision, which we have used quite frequently, in such as this, and I am quoting from page 902, where Learned Hand stated as follows:

> "Specifications are written to those skilled in the art, among whom judges are not. It therefore becomes necessary when the terminology of the art is not comprehensible to a lay person—"

The Court: Should I say that Judge Hand should speak for himself? He is taking in a lot of judges.

Mr. Marshall: But I think he does go on and make a generalized statement that is very applicable here.

He says:

> "—it therefore becomes necessary, when the terminology of the art is not comprehensible to a lay person, that [268] so much of it as is used in the specifications should be translated into colloquial language; in short, that the judge should understand what the specifications say. This is the only permissible use of expert testimony which we recognize. When the judge has understood the specifications, he cannot avoid the re-

sponsibility of deciding himself all questions of infringement and anticipation, and the testimony of experts upon these issues is inevitably a burdensome impertinence."

[269] The Court: I have listened to a lot of impertinence over the last fifteen years.

Mr. Marshall: I think, your Honor, that is the problem with patent attorneys trying cases here.

The Court: If there is validity to Judge Hand's observation, I don't ever remember having tried a patent case precisely in this manner.

I do hope, I do so hope that you and your firm are right.

I think a lot of time is wasted by so-called experts in the manner suggested by Judge Hand, even though, by the testimony of the experts, the responsibility of the trial judge may be lessened, the burden may be lessened.

But if you think that you have a prima facie case in here, certainly you would not have all that talent sitting at the table with all those books and papers.

Were these your depositions?

Mr. Marshall: Some of them are, your Honor, and some of them are not.

The Court: They go the way of all depositions, most of the depositions I hate to [270] see here. Sometimes they are up to the top of this bench, and are never used.

That is another way in which you could save your clients a lot of money. Mr. Marshall, to dispense with the taking of a lot of depositions.

Mr. Marshall: Yes, I agree with you your Honor.

The Court: Go ahead, I am sorry.

Mr. Marshall: I think, in this same general area, your Honor, I refer you to the 3-M case versus Carborundum Co., 155 F. 2d 746, at 749 (1946), where again the Court said:

"But quite apart from the foregoing, the words of

a patent or a patent application, like the words of specific claims therein, always raise a question of law for the Court and may not be determined by the opinion of experts."

I also refer you to *Watson* v. *Bersworth,* 251 F. 2d 898, at 900, and *Corning, et al.* v. *Burden,* 56 U. S. 252—

The Court: What you are saying in effect, is this, in reply to the argument in support of the motion, is that the physical and documentary [271] evidence here proves validity and infringement.

Mr. Marshall: Not validity.

The Court: And aided by the testimony of your so-called experts.

Mr. Marshall: That's right, but we didn't go into validity, your Honor, if you recall.

The Court: You are relying on the—

Mr. Marshall: We are relying on the presumption of validity.

The Court: You are relying on the presumption of validity?

Mr. Marshall: Yes.

The Court: All right.

Mr. Marshall: I did want to point out one other thing. I am sure that Mr. Rines did not intend to do this purposely, but there were three lines of questions that we asked.

We asked first of all whether or not Mr. Harris could testify that the antennas in question, first of all, had the same structural component as the antennas taught to those skilled in the art, by the patent, by the patent in suit —he again identifying a component as he went along.

We then asked him a second question, [272] which Mr. Rines did not mention, and this series of questions, your Honor, asked whether or not the structural components which Mr. Harris referred to, were combined in the same

way as the antennas which are taught by the Isbell patent.

Finally, we asked as to whether or not the antenna functioned in a same manner to give the same result as the antenna taught by the patent in suit.

Here again, your Honor, the prima facie situation is clearly established again by the doctrine of equivalence, if not the question of literal infringement. We do have literal infringement here.

I refer, for example, to *King-Seeley Thermos Co.* v. *Tastee Freez Industries, Inc.*, 357 F. 2d 875, 880 (7th Circuit, 1966).

I don't have the Fed. on this, your Honor, but it is 149 USPQ, page 4, and I am reading from page 8.

And this, of course, your Honor, is a Seventh Circuit case.

> "If the accused device achieves substantially the same results in substantially the same way as the patented [273] device, the devices are the same in the eyes of the patent law."

This is what we have clearly established, your Honor.

[274] The Court: Which one of our great Justices said that?

Mr. Marshall: This was Judge Hastings, your Honor.

The Court: Well, he truly is a great judge—not because of that necessarily, but he is a great judge.

Mr. Marshall: The panel was Judge Hastings, Castle, and Swigert.

The Court: That is pretty recent, isnt it?

Mr. Marshall: Yes, it is, your Honor. It is a 1966 case, decided March 14.

The Court: Why do you not have the Federal Second citations?

Mr. Marshall: I have no excuse, your Honor. I throw myself on the mercy of the Court.

The Court: Well, you may reply to this response.

Mr. Rines: Your Honor, in the case cited by Judge Learned Hand—

The Court: Don't promote Mr. Marshall.

Mr. Rines: Well, it is an important point.

The Court: It is not cited by Judge Learned [275] Hand. It is cited—

Mr. Rines: Excuse me—cited by Mr. Marshall. Judge Learned Hand pointed out that it was a requisite for the proof of a case that technically ambiguous language, language a lay judge did not understand, must be interpreted by the expert in ordinary terminology so you know what to do in terms of applying it. We submit, your Honor, that that has not been done with the specifications of these patents.

The Court: Well, I hope I ultimately can conclude that you are right. I really hope that, and I say in all the years I have been here, and with the many patent cases I have tried, I have never had a fine patent lawyer, a fine patent firm, assume the risk—and it is a risk—of resting after such a prima facie case as has been presented as is here the situation. But I think I will avail myself of the privilege which the United States Supreme Court so graciously gave the trial judges in Rule 41B in part, which permits the trial judge to decline to enter any judgment after such a motion until the close of all the evidence. I don't rule against you; I just decline to rule.

[276] Mr. Rines: Thank you.

The Court: So you may call your first witness, if you will.

Mr. Rines: I would like to call Dr. Mayes to the stand, please.

Mr. Marshall: Your Honor, may the record show that Dr. Mayes was not subpoenaed. We have no objection to this. He is appearing voluntarily apparently at Mr. Rines' request.

The Court: The record may show it if he is asked. I don't know whether he has been subpoenaed. Haven't you heard that statements of counsel are not evidence, Mr. Marshall?

Mr. Marshall: That's right, your Honor.

The Court: What difference does it make?

Mr. Marshall: None to me. I merely wanted the record to show.

The Court: I am sure counsel appreciates your—I don't know who this witness is. I assume that he is connected with the plaintiff in some way or another or with the patent.

Mr. Marshall: He is not an employee of the plaintiff, your Honor, nor a managing agent nor a director.

[277] The Court: In other words, they have to take their chances on this witness.

Mr. Marshall: That's right, your Honor.

The Court: All right. He may be sworn.

Thereupon the plaintiff rested its case in chief.

Thereupon the defendant to maintain the issues in their case presented the following evidence to-wit:

PAUL EUGENE MAYES, called as a witness by the defendant herein, having been first duly sworn, was examined and testified as follows:

Direct Examination by Mr. Rines.

Q. Would you please state your name, residence, and profession for the Court.

A. Paul Eugene Mayes, M-a-y-e-s; 1508 Waverly Drive, Champaign, Illinois.

I am a Professor of Electrical Engineering in the University of Illinois Department of Electrical Engineering.

Q. How long have you been associated with the University of Illinois?

A. Since the first of September 1954.

[278] Q. What relationship, if any, have you to the Paul E. Mayes, a co-patentee in Reissue Patent 25,740, Plaintiff's Exhibit 20?

A. I am the same.

Q. Who is the Robert L. Carrel mentioned in Plaintiff's Exhibit 20?

A. Who is he? He is an employee of the Collins Radio Company, located in Richardson, Texas.

Q. Was he always, to your knowledge, an employee of Collins Radio Company?

A. No.

Q. What was he before that?

A. He was a graduate student in the Department of Electrical Engineering at the University of Illinois.

Q. Was he one of your students, Dr. Mayes?

A. In what manner?

Q. In any manner.

A. I don't believe I would classify him as a student of mine. He did not, as I recall, take any classes for which I was the instructor.

Q. Was he a co-worker of yours at the University of Illinois?

A. Yes, he was.

[279] Q. Would you tell the Court your professional education and degrees.

A. I have a Bachelor of Science degree in Electrical Engineering which I received from the University of Oklahoma in 1950. I have a Master of Science degree in Electrical Engineering which I received from Northwestern University in 1952, and I have a Ph.D. degree which I also received from Northwestern University in 1955.

Q. I take it then that after you received your Doctor's degree, within a year or two, you were at the University of Illinois.

A. I went to the University of Illinois before I received my Ph.D. degree.

Q. Can you recount for us the circumstances under which you conceived the invention represented by the Mayes and Carrel Patent, Plaintiff's Exhibit 20.

A. Yes.

Mr. Marshall: Your Honor, I would like to know what the relevance of this particular line of questioning is.

The Court: I, first of all, am not sure that I understand the question, and I think perhaps there [280] is validity to the objection. You said "conceived," or "received"?

Mr. Rines: Conceived.

The Court: Conceived?

Mr. Rines: Conceived the invention. I can hardly think, your Honor, of anything more germane in a patent suit than the facts relating to conception.

Mr. Marshall: Your Honor, I don't believe that the pleadings are involved with challenging Professor Mayes' inventorship.

The Court: You might be in trouble yourself with that question. In your own interests, the interests of your client, I will sustain the objection to the question.

By Mr. Rines:

Q. Were you familiar during your tenure at the University of Illinois with the log-periodic antenna work of Isbell as represented in the Isbell patent, Plaintiff's Exhibit 1?

A. Yes.

Q. Will you tell the Court how you became so familiar with this work.

A. Isbell performed his research and did [281] his experiments in the antenna laboratory of the University in which I was also working.

Q. Did you follow pretty closely the work that Mr.

Isbell was doing in connection with his log-periodic invention represented by Plaintiff's Exhibit 1?

A. Yes, I did.

Q. Do you know whether any publications were issued with which you had any association describing the invention purported to be covered by the Isbell Patent, Plaintiff's Exhibit 1?

A. Yes.

Q. Will you tell us what publications you recollect.

A. I recall the publication in the Transactions of the Institute of Electronics and Electrical Engineers.

Q. Do you recall any publications that issued from your antenna laboratory at the University of Illinois?

A. There were reports which issued from the antenna laboratory.

Q. And you do recall these?

A. Yes.

[282] Q. Where were these reports sent?

A. They were sent to a distribution list of industrial firms and universities. The distribution list was compiled by the contract sponsor, with additions which were from time to time made with their approval.

Q. Would you tell his Honor what you mean by "the contract sponsor"?

A. The research work which Mr. Isbell was conducting was sponsored by the United States Air Force.

Q. And what relationship, if any, did you have to either this work or the reports of the laboratory?

A. I was also working under the same contract, and in some instances was supervisor for the preparation of the reports.

Q. Besides the distribution list of these reports that you testified concerning, were these reports sent to any libraries that you know of?

A. Yes, I believe they were.

Q. Do you know some of the libraries?

A. The library of the College of Engineering is one. I am not sure about any other libraries.

[283] Q. That would be at the University of Illinois.

A. At the University of Illinois.

Q. Do you remember the Library of Congress in Washington, D. C.?

A. I did not specifically remember that this was the case.

Q. You do know there are other libraries to which the report was sent.

A. I recall at the present time only that it was sent to the College of Engineering Library at the University of Illinois.

Q. Were these reports otherwise available to interested members of the public in your antenna laboratory at the University of Illinois?

A. They were generally available.

Q. So that any interested party who was interested in this particular field and knew that there was a report could either inspect this at your antenna laboratory or ask for a copy, is that a fair statement?

A. They could ask for a copy. We did not always supply copies. They were in somewhat short supply, and requests were not at all times [284] granted for supply of copies of the report.

Q. But if you had the copies, you would supply them?

A. Not in all cases. We have at times refused to supply copies because of our short supply.

Q. But you have supplied copies on request of members of the public.

A. We have supplied copies on request to some members of the public, yes.

Q. I would like to show you a blue covered booklet and ask if you can identify it.

A. This is a copy of a Quarterly Engineering Report which was issued under an Air Force contract by our laboratory.

Q. Can you tell us who signed that report?

A. It bears two signatures—Professor Deschamps and myself.

The Court: What is the number?

Mr. Rines: Defendant's Exhibit No. 7, your Honor.

Mr. Rines: I offer in evidence Defendant's Exhibit No. 7, your Honor.

The Court: Show it to counsel.

[285] Mr. Marshall: No objection, your Honor.

The Court: With no objection, Defendant's Exhibit 7 for identification may be admitted into evidence as Defendant's Exhibit 7.

(Said document heretofore marked Defendant's Exhibit No. 7 for identification was received in evidence.)

By Mr. Rines:

Q. At this time, Mr. Mayes, I show you another blue report and ask you if you can identify this, which is marked for purposes of identification as Defendant's Exhibit No. 8.

A. Yes, this is another Quarterly Engineering Report which was issued under the same contract.

Q. And who signed that report, sir?

A. The same people.

Mr. Rines: I offer in evidence Defendant's Exhibit No. 8.

Mr. Marshall: No objection, your Honor.

The Court: With no objection, Defendant's Exhibit 8 for identification may be admitted into evidence as Defendant's Exhibit 8.

[286] (Said document heretofore marked Defendant's Exhibit No. 8 for identification was received in evidence.)

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[290] By Mr. Rines:

Q. Dr. Mayes, referring to the report, Defendant's Exhibit 7, I notice that is numbered Report No. 1. Would you explain the significance of that to his Honor.

[291] A. These quarterly engineering reports were issued more or less every three months in sequence for the life of the contract—in this case, Report No. 1 is evidently the first report of that sequence.

Q. Would you show his Honor whether there is anything in that report that gives the distribution list of the people to whom this was sent?

A. Yes, there is a distribution list.

Q. Would you give us the pages of that?

A. There are no page numbers.

Q. Is it the last four or five—

A. The last six pages of the report on which printing appears.

Q. Do you find anything in that report, Dr. Mayes, which bears upon the work of Mr. Isbell in connection with the invention purported to be covered by Plaintiff's Exhibit 1?

Mr. Marshall: Your Honor, I object to the scope of that question.

The Court: I sustain the objection.

By Mr. Rines:

Q. I would like to call your attention to the center of page 2 of Defendants' Exhibit 7, [292] where the statement appears:

> "An investigation of log-periodic structures of thin linear elements (zero tooth width); is planned,"

and ask you whether that has any bearing upon the patent in suit, Plaintiff's Exhibit 1.

Mr. Marshall: Your Honor, I object to his characterizing it as relating or bearing on the patent in suit.

The Court: I think the question is bad certainly as a matter of form. I therefore sustain the objection and too, I think it invades the province of the tryer of the facts.

Mr. Rines: I didn't hear your Honor.

The Court: I say, and, too, the answer to the question would invade the province of the tryer of the facts.

By Mr. Rines:

Q. What is a log-periodic antenna of zero tooth width, as mentioned on page 2 of Defendants' Exhibit 7?

Mr. Marshall: I object to that question, your Honor. I don't think that that is a proper type of question. I don't think there is a log-[293]periodic—

The Court: I sustain the objection.

By Mr. Rines:

Q. Has the investigation referred to on page 2 as "an investigation of log-periodic structures of thin linear elements (zero tooth width)" any bearing upon your previous testimony relating to the work done at the University of Illinois Laboratory?

A. This is a statement of the plans which Mr. Isbell intended to carry out during a succeeding period of the research work and about which I previously testified, whi- he did in the antenna laboratory of the University of Illinois.

Q. Has that work any bearing upon Plaintiff's Exhibit 1?

Mr. Marshall: Your Honor, again I object to that question.

The Court: I sustain the—

Mr. Rines: Would your Honor tell me why I am not entitled to that question? I don't understand.

The Court: I will tell you why once again. I think there is no obligation on my part—

[294] Mr. Rines: I understand that, your Honor.

The Court: I say you are too accomplished a trial lawyer not to know why, but I will tell you why.

First, it calls for a conclusion of the witness, and the form of the question is bad.

By Mr. Rines:

Q. Is the work of Mr. Isbell, to which you have referred, the antenna of the type shown, for example, in Fig. 1 of Plaintiff's Exhibit 1?

Mr. Marshall: Your Honor, I again object to that question.

The Court: I sustain the objection. If it does—don't scowl. We are only trying a lawsuit. I am not angry at you. I don't know why you should be angry at me. To me you are just a partisan advocate. You may prevail here, but I want a lawyer who smiles to prevail, not one who scowls at me merely because I make a routine ruling on an objection. I sustain the objection to the question.

We don't have scowlers here.

Mr. Rines: I apologize if I am scowling, your [295] Honor, but I am confused.

By Mr. Rines:

Q. What does the zero tooth width mean in the quotation we have been testifying about, Dr. Mayes?

Mr. Marshall: Your Honor, I object to that question as to what it means to him, or to whom. The document would speak for itself.

The Court: It is in evidence, and you offered it; there was no objection to it. I will read it. I will read every exhibit that is in evidence before I decide this case, but I don't need him to tell me what it means, because I may not agree with him as to what it means. The document will speak for itself.

I sustain the objection to the question.

By Mr. Rines:

Q. Do you find, in Plaintiff's Exhibit 1, Dr. Mayes, any log-periodic structure of thin linear elements?

Mr. Marshall: Your Honor, I hate to burden the Court with this constant interruption of Mr. Rines—

[296] The Court: If you think the question is not proper, it is your duty to object. I may not always agree with you, but you have a responsibility to your clients. You never have to apologize for objecting.

Mr. Marshall: Again, the document speaks for itself; as to whether or not Dr. Mayes can find it here I think is irrelevant. If it is in there, it is in there, and your Honor can find it as well as Dr. Mayes.

The Court: I agree. I sustain objection to the question.

By Mr. Rines:

Q. Would you turn, please, Dr. Mayes, to Report No. 2. Has this any bearing upon your previous testimony relating to publications describing the Isbell invention, purported to be covered by the patent, Plaintiff's Exhibit 1?

The Court: No, Report No. 2?

Mr. Rines: Defendants' Exhibit 8, yes, sir.

The Court: Defendants' Exhibit 8. You referred to it as Report No. 2, I thought.

Mr. Rines: I did, your Honor.

The Court: What did you say?

[297] Mr. Rines: I did, your Honor.

The Court: That didn't mean anything to me because I have it down here as Defendants' Exhibit No. 8.

Mr. Rines: Defendants' Exhibit No. 8, your Honor.

The Court: I just wanted you to know I was listening.

Mr. Rines: Thank you.

The Court: Did you object to the question?

Mr. Marshall: Your Honor, again I am going to object because "has any bearing" is too broad. "Whether it

has any bearing'' is entirely too broad. I don't know what it means.

The Court: I sustain the objection.

[298] By Mr. Rines:

Q. As one who has followed the development of these log-periodic antennas and one skilled in this art, do you find in Report No. 2, labeled No. 2, Defendants' Exhibit 8, any description of the log-periodic antennas of the type described in Plaintiff's Exhibit 1?

Mr. Marshall: I object to the question, your Honor. The document speaks for itself.

The Court: I sustain the objection.

Now, I know, counsel, that a witness of this witness' intellectual background is going to be absolutely honest in his testimony, but suppose he were a witness who wasn't honest, and he said, ''No, I don't,'' when actually there is some reference or vice versa? That is why we have a rule of evidence that the document speaks for itself.

I will read it, and you may, in your argument later, comment on the fact, if it is a fact, and if it is significant.

Mr. Rines: Well, your Honor, is it my stupidity, or am I understanding your—

The Court: I ask you not to complete that [299] question because you might put me in a very embarrassing position.

Mr. Rines: I would like the answer, your Honor, to know whether your Honor's ruling means that I have no right to ask one skilled in the art what is disclosed in the report?

The Court: I take one question at a time.

Mr. Marshall: Your Honor, I also would like to ask whether Mr. Rines concedes that Dr. Mayes is skilled in the art. He has been referring these questions to him as one skilled in the art, and he has prefaced his remarks with this particular phrase. I would like to—

The Court: He has referred to him as one skilled in the art, and the witness is his witness—although I grant you that there were not a sufficient number of qualifying questions and answers preceding his characterization.

Mr. Marshall: Your Honor, I am not objecting to his so characterizing him, but I wish to know whether or not Mr. Rines does so believe.

The Court: If a lawyer so describes his own witness, I suppose I may assume that he is skilled in the art.

[300] By Mr. Rines:

Q. Dr. Mayes, can you recall what happened in connection with Mr. Isbell's work on his antenna, Plaintiff's Exhibit 1, after the report, Defendant's Exhibit 7, was issued?

A. Could you clarify that question? In what sense what happened?

Q. What did he do on the project mentioned in there?

Mr. Marshall: I object to the question, your Honor, as being vague. What project?

By Mr. Rines:

Q. We have been testifying about a project, Dr. Mayes, or you have been, on Page 2, that describes these log-periodic thin dipoles, and you stated that this was a piece of work that Mr. Isbell was going to work on. Would you describe to his Honor what work Mr. Isbell did following that report, bearing upon that.

A. Following this report what he actually did?

Q. Yes, sir.

A. During the period of time after the date which appears on this report—

[301] The Court: You may stop answering the question until the lawyer who asked it is listening to you so that he will know what your answer is, and so that he can frame the next question.

Mr. Rines: Excuse me.

The Court: Have you finished your conference?

Mr. Rines: Yes.

The Court: All right.

By the Witness:

A. Mr. Isbell was engaged in a research project, investigating certain types of log-periodic structures. He constructed a number of these structures and performed experimental measurements on them in order to evaluate whether they were acceptable in their performance with regard to their radiative properties and other important characteristics, which are used to evaluate antennas.

By Mr. Rines:

Q. What properties?

Mr. Marshall: May I hear that last question, please?

(Question read.)

Mr. Marshall: Your Honor, again this goes to the question of relevancy.

[302] The Court: The witness has answered the question.

Mr. Marshall: I know. He hasn't answered the last one, I don't believe, your Honor.

The Court: What did you say?

Mr. Marshall: There was another question posed, "What properties?"

The Court: Oh, there was one after the answer?

Mr. Marshall: Yes, your Honor. Is that right?

The Court: Just two words, "What properties"?

Mr. Marshall: Yes, your Honor.

Mr. Rines: The witness just referred to properties in the preceding answer, your Honor.

The Court: You didn't object to the question before then. I let the answer go in because you did not object, and perhaps it was a valid question as well, but since the

question was asked, the answer given, I think counsel has a right to ask the witness to explain what he meant by the use of those two words.

Mr. Marshall: Very well, your Honor.

The Court: He may answer, over objection.

By the Witness:

A. The principal properties which he was [303] interested in were the directional characteristics of the radiation, generally described by radiation pattern, and the input impedance of the antenna as displayed at the feed terminals, the feed point of the antenna structure.

By Mr. Rines:

Q. Did he reduce the tooth width to zero as suggested in the report?

Mr. Marshall: I object to that question, your Honor.

By Mr. Rines:

Q. Defendant's Exhibit 7?

The Court: I sustain the objection.

If you look like that again, I am going to ask you whether you think I am stupid, Mr. Rines.

I don't like that sort of thing on the part of a lawyer, and I won't have you do it again, sir. I don't want to have a lawyer look at me as though I am a person afflicted as non compos mentis. I am doing my best to rule properly, sir.

Mr. Rines: Your Honor, I don't mean any disrespect.

The Court: Well, just don't look at the Court that way. The heavens won't fall because [304] I rule on one objection, sir. You can't have everything your own way in the trial of a lawsuit. I can't, and you can't.

* * * * *

[312] By Mr. Rines:

Q. Professor Mayes, what would you characterize, in simple lay language, as the principal technical difference between the antenna described in the Isbell Patent, Plaintiff's Exhibit 1, and the antenna described in your patent with Carrel, Plaintiff's Exhibit 20?

Mr. Marshall: Your Honor, I object to this question on the grounds that it calls for an interpretation of the respective exhibits by the witness.

Mr. Rines: Your Honor, I asked for a technical explanation of the differences in the antenna.

The Court: You didn't ask for a technical explanation. You said, "in simple lay language." He can use the language, in any answer he makes here, he can use the language that his education permits him to use and I will try to understand it. He doesn't have to use simple language necessarily.

[313] I think the form of the question is bad. I therefore sustain the objection to the question.

By Mr. Rines:

Q. Dr. Mayes, would you tell us technically what is the difference between the Isbell type antenna and the antenna that you and Mr. Carrel made that is described in the patent Plaintiff's Exhibit 20.

Mr. Marshall: Your Honor, I again object to that question. I don't think that Dr. Mayes should be called upon to give any differences between the Isbell Patent and the Mayes and Carrel Patent, or the antennas which are in each of them.

The Court: I will sustain the objection.

[314] By Mr. Rines:

Q. Did you make any improvements on Mr. Isbell's structure?

Mr. Marshall: I object, your Honor, as calling for a legal conclusion.

The Court: Sustained.

By Mr. Rines:

Q. What technical use did you make of Mr. Isbell's prior work in evolving the antenna of your patent?

Mr. Marshall: I object to this as calling for a conclusion, your Honor.

The Court: I will sustain the objection.

* * * * *

[316] Q. The Mayes and Carrel patent continues in column 1, starting at line 40:

"In accordance with the present invention—"

I am quoting—

"it has been found that the directivity of an antenna of the type described in the aforementioned application—"

and there am I correct in assuming that you are referring to the application of Dwight Isbell, mentioned previously?

A. Yes.

Q. (Continuing reading:)

"—may be increased, and the effective [317] frequency range of an antenna of a fixed size may be extended by inclining the dipole of Isbell to form 'V' elements, each of which consists of two straight arms of equal length, defining an apex which points away from the direction of radiation of the antenna, which is also the direction in which the element size decreases."

Would you by reference to the numbers on the drawing in Fig. 1 of Plaintiff's Exhibit 20, show us what is this bending into the V-shape—just describe it.

Mr. Marshall: Your Honor, I believe the document again speaks for itself. I object to the question.

The Court: I sustain your objection.

* * * * *

[325] Q. Yesterday, Dr. Mayes, we were discussing two reports that you say you signed emanating from the laboratory of the University of Illinois, Defendant's Exhibits 7 and 8. Do you recall those?

A. Yes.

Q. You told us at that time that depending upon the availability of copies of these reports, they would be distributed to members of the public who requested them, is that correct?

A. Yes.

Q. Was there any established policy restricting the distribution of the reports, Exhibits 7 and 8, at the time of their issuance that you know of.

A. The only policy I believe was with regard to the number of reports which the government would pay for the printing of. There was a restriction on the number of reports that could be printed at government expense.

Q. Are you not aware that the University of [326] Illinois had the custom of printing extras at its own expense?

A. They did a certain number of extra copies. A certain number of extra copies were usually printed of technical reports at the expense of the University.

Q. And Exhibits 7 and 8 are such technical reports?

A. No. Exhibits 7 and 8 are Quarterly Engineering Reports.

Q. Are you aware that with regard to Quarterly Engineering Reports, the University of Illinois would print extra copies at its own expense?

A. With regard to Quarterly Engineering Reports, I believe that the policy was that a very limited number

sufficient to supply members of our laboratory with copies of the reports would be printed at University expense.

* * * * *

[327] Q. Dr. Mayes, does the University of Illinois to your knowledge derive any financial benefit from the Mayes and Carrel Patent, Plaintiff's Exhibit 20?

Mr. Marshall: Your Honor, I object to that question on the ground it is irrelevant and immaterial. I don't think that makes any difference in this instance.

The Court: Oh, I don't think the witness is an officer of the University. He is a member of the faculty.

Mr. Rines: If he knows, your Honor.

The Court: I will sustain the objection.

By Mr. Rines:

Q. Do you personally derive any financial benefit from sales of antennas made in accordance [328] with your patent, Plaintiff's Exhibit 20, Dr. Mayes?

Mr. Marshall: I object to that question on the grounds it is irrelevant, your Honor.

The Court: I sustain the objection.

By Mr. Rines:

Q. The pleadings, Dr. Mayes, state that a license agreement was entered into under your Mayes and Carrel Patent, Plaintiff's Exhibit 20. Have you any personal knowledge of this license agreement.

A. I have been told that such an agreement exists.

Q. Have you ever seen it?

A. No.

Q. Do you have any agreement with the University of Illinois or the University of Illinois Foundation under the terms of which you receive remuneration for licenses granted under your Mayes and Carrel Patent, Plaintiff's Exhibit 20?

Mr. Marshall: I object to that question, your Honor.

The Court: I sustain the objection.

By Mr. Rines:

Q. In what capacity do you work for the [329] University of Illinois?

The Court: I think he has told you but I will let him answer again if you have forgotten.

Mr. Rines: Please, your Honor.

By the Witness:

A. Professor of Electrical Engineering.

By Mr. Rines:

Q. Do you have any employment connection with the counterclaim defendant JFD?

A. I have served as a technical consultant for JFD Electronics Company.

[330] Q. Can you tell his Honor at what time you first started serving as technical consultant for JFD?

Mr. Marshall: Your Honor, I would like to interject an objection at this time in view of the fact that Mr. Rines is getting into some apparent relationship between Professor Mayes and JFD that has no bearing as to the order of proof which this Court had entered into, namely—

The Court: I will sustain the objection.

By Mr. Rines:

Q. I would ask you, please, to examine the file history, Defendant's Exhibit 12, and turn particularly to pages 31 through 36, entitled "Affidavit Under Rule 131."

The Court: I have it. Do you want it back?

Mr. Rines: No, your Honor. May I show that to the witness?

The Court: Is this your copy or mine? You may keep it. I don't insist on having it, but I thought you gave it to me—

Mr. Rines: That is a copy in evidence.

The Court: Well, it isn't marked. I don't know whether that's it or whether this is it—it has no identifying number—or whether this is it. This has no identifying number.

Mr. Rines: Your Honor, may I call your [331] attention to the fact that the identifying number appears in the stamp.

The Court: Identifying number right in the center of the document? That is the wrong place to put it. I don't know who put it there. That looked like a part of the document.

Mr. Rines: I agree. No, your Honor. I am sorry that the stamp is there.

The Court: All right.

Mr. Marshall: Your Honor, I am at a handicap. I must apologize to the Court for this delay, but I do not have a copy of my file history here. I sent Mr. Scarpelli back to get it.

Mr. Rines: I would be glad to have counsel look at it with me if he would like to.

By Mr. Rines:

Q. That is your signature on page 32 of this affidavit, is it not, Dr. Mayes?

A. Yes, I believe it is.

Q. Do you recall the circumstances under which you prepared that affidavit and signed it?

A. This was during the course of the application in the Patent Office. I believe this was done at a time after we had received an action from the Patent Office on our application and the attorney was preparing an amendment to [332] submit to the Patent Office and asked me to sign this affidavit to be submitted in connection with that amendment.

Q. Might I invite your attention, please, to the preced-

ing page, number 30, in Defendant's Exhibit 12, and ask you if that is the Office action to which you referred?

A. I presume that it is.

Q. Would you read into the record, please, the reference that the Patent Examiner cited in the Office action on page 30, under the title "Reference Made of Record."

A. "IRE transaction on antennas and propagation, May 1960, Volume AP 8, No. 3, pages 260 to 267, copy in Scientific Library, Number TK 6800 comma I 12."

Mr. Marshall: Was that I 12, Mr. Rines?

The Witness: I-II, excuse me.

Mr. Rines: Roman numeral 2.

By Mr. Rines:

Q. What follows after that?

A. There is a pencil notation, "Isbell."

Q. With that refreshing you, can you tell his Honor what was the intent and purpose of your signing affidavit on pages 31 and 32?

Mr. Marshall: Your Honor, I object to that [333] question.

The Court: I sustain the objection.

By Mr. Rines:

Q. Did you, at the time you signed the affidavit on pages 31 and 32 of Defendant's Exhibit 12, know that Isbell, the same Isbell mentioned in the Office action on page 30, had published other papers on his log-periodic antenna, the subject matter of the patent in suit, prior to this May 1960 IRE publication?

Mr. Marshall: Your Honor, I object to this line of questioning on the grounds that it is irrelevant, because, first of all, if there were any prior publications with which Dr. Mayes was familiar, they are either of record in this case or will be cited as references and therefore will be adjudicated on the merits as to whether or not they con-

stitute prior art. So from the standpoint of the law in this circuit, as I understand the law, your Honor, a patentee or an applicant for a patent is not required to bring to the attention of the Patent Office a reference merely because he believes it's pertinent. The law, as I understand it again, is that a patentee is, however—or an [334] applicant for a patent—is under an obligation to bring a reference to the attention of the Patent Office if the Patent Office fails to find it during the course of its search only if it is in anticipation of the invention.

Now, from the standpoint of the references which Dr. Mayes may or may not have been familiar with before this, these will go into the record, I assume, and will be adjudicated on the merits of whether they do or do not teach the invention.

Now, with that thought in mind, your Honor, I would like to object to this line of questioning as being irrelevant.

The Court: You may reply to the objection.

Mr. Rines: Thank you, your Honor.

This whole line of testimony, your Honor, is not directed to prior art. The pleadings allege that misrepresentations were made to the Patent Office in the course of the prosecution of these patents, which led the Patent Office erroneously to grant this patent. The question that I have directed to this witness, who is the one who executed the affidavit for the purpose of—

The Court: You say the pleadings. Which?

[335] Mr. Rines: The counterclaim, your Honor. We have a counterclaim for the declaring of the Isbell and Mayes and Carrel patents not only invalid and noninfringed but unenforceable because of the conduct of the plaintiffs in this particular and also in the answer of the plaintiff's case for patent infringement. We have said these patents are unenforceable because of the inequitable conduct of the plaintiff in the prosecution of these patent.

So that this questioning goes to the bona fides, if you will, of filing an affidavit, swearing back of a publication that the examiner thought was prior art—

The Court: Are you saying to me that there is something this witness did that was not in good faith?

Mr. Rines: Yes, your Honor.

The Court: I sustain objection to the question. He is your witness. You may not cross-examine him. You may not impeach him.

Mr. Rines: May I respectfully invite your Honor's attention to the fact that while I have called Dr. Mayes as my witness, I believe he is in the category of a hostile witness.

[336] The Court: That requires judicial determination. It hasn't been determined here, sir. I haven't noticed that this professorial looking gentleman is hostile. He has answered questions, I get the impression, with candor. I would even have suggested he raise his voice. Certainly his manner hasn't been hostile toward you or toward your client.

Mr. Rines: No your Honor. I did not mean hostile in that sense.

The Court: I sustain the objection, and I don't reach any of the reasons given by Mr. Marshall. You have brought this witness to the stand as your witness, and you are bound. You may not cross-examine him, sir. You may not attempt to impeach him.

The old fashioned rules of evidence apply in patent cases as well as in general law. Some patent lawyers don't seem to think so.

• • • • •

[389] Q. I believe that your earlier testimony was to the effect that you started your professional career in about 1954, is that correct?

A. That is the time at which I went to the University of Illinois.

[390] Q. Would you describe briefly the work which was going on at the University at that time?

A. There were a number of projects in the Antenna Laboratory which were sponsored by the United States Air Force having to do with problems associated with antennas on high speed aircraft. One of the most pressing problems was that of achieving an antenna configuration which was capable of maintaining performance that was uniform over an extremely wide frequency band. There were other projects also associated mainly with airborne antennas.

Q. Would you describe briefly the results of this research work?

A. With respect to the problem of maintaining performance of an antenna over a wide frequency band, there were some proposals made by the man who was then director of the laboratory, Professor V. H. Rumsey, that certain shapes of conductors would display an improved characteristic as far as the performance over a wide frequency band was concerned. One of his graduate students undertook a project of investigating these shapes of conductors and did, in fact, show that they had not only the potential, but the actual realization of what we soon came to characterize as frequency independent performance in order to distin- [391] guish these new antennas from antennas which had been known heretofore.

A little bit later, Professor R. H. DuHamel, who was also working on this same contract in our laboratory, began an investigation of a different type of antenna which he thought also had the potentialities to perform over a wide band of frequencies. He collaborated with various students in the laboratory in this investigation, one of which was Dwight E. Isbell.

Working together, they did arrive at some shapes of conductors which displayed the desired sort of performance, maintaining the characteristics, electrical characteristics,

which did not change appreciably over an extremely high band of frequencies.

These shapes became known as logarithmically-periodic antennas or logarithmically-periodic structures, of which the more successful ones have been referred to as antennas, and they were able very soon to publish a number of results which indicated the success of this project.

Q. Do you know the approximate time when Dwight Isbell made the invention which is described in the Plaintiff's Exhibit No. 1?

A. Do you have a copy of the exhibit?

[392] Yes. This particular development was made in the latter part of 1958, early part of 1959. This is the period of time in which the work on this particular project was under way that is described in this exhibit.

Mr. Rines: Your Honor, I am confused. I don't know what exhibit he is referring to.

Mr. Mann: That is PX 1.

By Mr. Mann:

Q. Prior to the time that you testified that Isbell made his invention, how many antennas had been developed at the University of Illinois which exhibited frequency independent performance or performance over a wide band?

A. Probably three or four.

Q. Would you describe those briefly?

A. One of the early—the earliest type, I would say, of frequency independent antenna was in the shape of a spiral, and this was the shape which Professor Rumsey had originally proposed as having a potential for frequency independent performance.

The first spirals which were of a particular type, called equi-angular or logarithmic, were constructed out of planar sheets of metal. In some cases they were made as openings or slots in a large conducing screen; in other cases they were made of conductors which were simply formed

in the [393] shape of the spiral, where the outlines of the antenna were described by spiral curves.

Q. May I interrupt just a minute? Dr. Mayes, with the permission of the Court, if you feel that your discussion would be assisted by a presentation at the sketch pad there, I would suggest that you use it.

The Court: You may step down.

By the Witness:

A. The spiral curve which I made reference to is one which looks something like this, and of course one of these curves is not sufficient to define an antenna structure. Another curve can be obtained from this one simply by rotation, and it might then appear something like this.

These two curves then would be used as the borders or the outline for one arm of antenna.

The curve itself would extend indefinitely in toward a limit point, of smaller and smaller dimensions. The curve would also extend, of course, to infinity. In any practical antenna structure it is necessary to make truncations, one at the end having the small dimensions, and another at the end having large dimensions. So the first antennas that were constructed were built roughly in this form— [394] I don't have enough room on the sheet to show a more accurate diagram—where there are two members which are conducing sheets to form the arms of the antenna.

Q. Who was the inventor of that type of antenna?

A. This antenna—this shape of antenna was originally suggested by Professor Rumsey.

[395] Q. What was the name by which this antenna was called?

A. This was called an equi-angular or logarithmic spiral antenna.

Q. Would you mark the sheets showing the equi-angular or logarithmic spiral antenna—would you also mark this as Exhibit 45?

(Said document marked Plaintiff's Exhibit No. 45, for identification.)

By Mr. Mann:

Q. Will you continue your discussion of the other types of antennas that were developed?

A. The class of antennas which I previously referred to as logarithmically periodic which have come to be known as log-periodic structures and in successful cases as log-periodic antennas were in the early form derived from two triangular shapes such as this. (Indicating.)

This is an antenna which would be referred to as a biconical fin or bow-tie antenna which does not display the desired characteristic of frequency independence.

Dr. Isbell proposed—or Dr. DuHamel, excuse me, first proposed that this shape be modified [396] in such a way that we might approach a more nearly uniform performance over frequency band, and the modifications that he proposed were the addition of what we came to call teeth in the laboratory which were once again metallic members, this being a planar sheet metal structure and these members extended outward from the edges of the original biconical fin structure.

These teeth were added in a particular type of geometric configuration for the purpose of hopefully achieving the desired results, and I am indicating how the extensions on one side of the sheet were interlaced, shall we say, with extensions on the other side of the sheet where there was a slot on this side, there was a tooth on this side, and so forth down the structure. (Indicating.)

Then the second half of the structure was of a similar shape; where the first tooth that I have shown here, the smallest one would appear instead on the other side of the triangular piece of metal, and then you would have the continuation of these teeth in the same manner.

In other words, this half of the [397] structure was identical to that one except that it was rotated by 180 degrees.

Q. That will be fine, Dr. Mayes.

Was either of the two antennas which you have just described suitable for use as a commercial television antenna?

A. No, they were not.

Q. Why not?

A. These structures first of all were made from planes of sheet metal. In the television frequency band they would have been extremely large, very difficult and expensive to manufacture, and it would not have been possible to mass produce these and sell them in a competitive market.

Q. What kind of directivity did these antennas display?

A. The antennas which have been described, since they were confined to a single plane, were bidirectional in nature —that is to say, they would respond equally well to signals arriving from either side of the structure.

Q. Is this a desirable or undesirable characteristic insofar as the reception of commercial [398] television is concerned?

A. For most applications in the commercial television band, this would be undesirable. The characteristic that is usually required is one which is unidirectional where the antenna will respond to signals arriving only on one side of the antenna and not on the other.

Q. Prior to the production of Isbell's antenna described in Plaintiff's Exhibit 1, were there any antennas developed at the University of Illinois Laboratory that did have a unidirectional pattern?

A. Yes.

Q. Who developed such an antenna?

A. Dwight Isbell.

Q. Would you describe it briefly, please.

A. Mr. Isbell in a continuing investigation of this type of structure—

The Court: I think that the witness when he says "this type of structure," having testified without referring to that exhibit for several minutes, should identify what he means when he says "this type of structure."

Mr. Mann: I will try to point it out.

[399] Dr. Mayes, in your testimony will you try to refer to a specific exhibit rather than "this" because "this" does not show on the record.

Will you please mark that tooth, bow-tie sketch with the number Plaintiff's Exhibit 46.

(Said document was marked Plaintiff's Exhibit 46, for identification.)

By Mr. Mann:

Q. Will you continue, please?

A. Yes.

When Mr. Isbell continued the investigation of the type of structure which is depicted here in Plaintiff's Exhibit No. 46, he, in effect, spoiled the symmetry of the structure so that it no longer was confined to a single plane and observed the result that the radiation pattern or the directional response of this structure was thereby changed to one which was unidirectional rather than bidirectional.

Q. Would you explain in a little more detail for the benefit of the Court what you mean by "destroying the symmetry of the antenna"?

A. If we look at an edge-on view of what I have drawn here in Plaintiff's Exhibit No. 46—

[400] Q. May I suggest that you start a new sheet and mark it as Exhibit 47 for identification.

(Said document was marked Plaintiff's Exhibit No. 47, for identification.)

[401] A. These two vertical lines now—

Q. I am sorry to interrupt, but would you put a capital there.

A. —indicated with a capital A are intended to depict the edge-on view of the structure which was shown in an individual view in Plaintiff's Exhibit Number 46.

The process which Mr. Isbell used in order to obtain the unidirectional characteristic was one of changing the angle, so indicated by B on this diagram so that it is no longer equal to 180 degrees. The structure now is no longer confined to a single plane, and the radiation pattern of the figure which is labeled C here and depicts once again an edge-on view of the structure, was observed to be unidirectional.

Q. In which direction was the pattern?

A. The principal direction of radiation from this antenna acting as a transmitter would be in the direction indicated by the arrow. Perhaps I should say B′ to indicate the altered angle in the figure depicted by C and call this arrow D, which shows the direction of radiation.

Q. Were there any limits on the angle B′ for operation of this antenna?

[402] A. Yes. There were limitations on the size of angle B′. Mr. Isbell found that if the angle B′ were made too small, the input impedance characteristic of this antenna was not independent of frequency but in fact did have rather wide excursions as a function of frequency.

Q. For the benefit of the Court, what is the effect of these wide excursions in impedance on the suitability of such an antenna for practical use?

A. The characteristic which is referred to by engineers as the impedance of an antenna in effect describes the ability of the antenna to deliver power from the antenna structure itself to the transmission line or to a receiver which is connected to the transmission line.

Q. I am sorry, did I interrupt?

A. Yes. When the impedance then changes with frequency, since the impedance of the transmission line does not change with frequency and it is an equality of these two impedances which is of importance, the amount of power which is delivered by the antenna to the transmission line will fluctuate with [403] frequency.

Q. How would you describe the performance of the antenna such as that depicted by your sketch C in the instance when the angle B′ was zero?

A. When the angle B′ goes to zero, the input impedance is very poor with respect to uniformity across the frequency band.

Q. Is such an antenna capable of practical use?

A. No.

Q. Thank you. Would you resume your seat.

* * * * *

[404] Q. Dr. Mayes, will you define for us what is meant by a log-periodic antenna?

A. I might start with a definition of a log-periodic structure. I personally would like to distinguish between a structure which has a log-periodic geometry and a log-periodic antenna. The log-periodic structure is one which has a distinguishable basic unit which is usually referred to as a cell, and the structure is made up of a repetition of the cells. The cells are similar in shape but different from one another in size.

[405] Q. Would you, by reference to any of Plaintiff's Exhibits 45, 46 or 47, point out the cells in the log-periodic antennas shown there.

A. I believe that the one which would be most suitable for this purpose is depicited in Plaintiff's Exhibit No. 46.

I have indicated here, by some dashed lines, the inner and outer boundaries of a single cell of this structure. These lines would be described as circles having a point, which I have labeled here O as center, these circles also

having different radii, and when inscribed completely on this figure, including the metallic structure, would describe the boundaries of a single cell. The remaining cells in the structure then would be obtained in a similar manner by inscribing circles having different radii.

Q. Could you mark on one of the larger teeth by means of a dashed line what you would consider one cell, so that it shows at the larger end of the antenna.

A. This drawing is not too satisfactory for that purpose because the scale is not too good, [406] not too accurate, but—

Q. Can you describe in words what a cell would consist of in that antenna—referring to that exhibit, of course, Plaintiff's Exhibit 46?

A. A single cell in this structure would be a portion of the triangular section, which I will label A and A'—these are the two triangular sections—and the toothed extensions thereto, which are contained by circles having different radii.

Q. Would you refer to Plaintiff's Exhibit No. 1, please, Dr. Mayes. You see in the patent, the Greek letter Tau, do you not?

A. Yes.

Q. What is the letter used to represent in the patent?

A. The letter is used to represent the ratio of lengths of adpacent dipoles and the ratios of spacing between adjacent dipole pairs.

Q. And that Greek letter is described as having essentially constant values, is it not?

A. Yes, the constant scale factor Tau.

Q. Does the structure in Plaintiff's Exhibit 46 adapt itself to analysis in the same manner, [407] using the Greek letter Tau?

A. Yes.

Q. Would you explain that, please?

A. If we draw a radial line from the point O out to some point on the structure in one of the cells, we could, for example, use the distance from O to P as depicted here on Exhibit No. 46 and call that distance R_n. If we draw another radial line from O to Q, the distance O-Q being the distance from the orgin O to a point on one tooth of this structure and the distance O-Q being the distance from the origin to the corresponding point in the next larger tooth of the structure, and label that distance R_n+_1, then the scale factor Tau is the ratio of the smaller of these distances to the larger one—that is to say, as given by the formula Tau is equal to R_n to R_n+_1.

Q. In the structure shown in Plaintiff's Exhibit 46, does Tau have a substantially constant value, or does it vary?

A. It has a substantially constant value.

Q. Would you resume the stand, please.

Does the presence of a repeating cell [408] structure insure wide band performance in an antenna?

A. No.

Q. Would you explain that in a little more detail?

A. As I indicated previously, the presence of repeating cell structure is indicative of a log-periodic geometry; that is, the geometry of the structure has certain properties. However, there is no assurance that an antenna built of conducting elements having such geometry will, in fact, perform as a frequency independent antenna to which I would apply the name log-periodic antenna.

Q. Is there any way of predicting what form of cell which, when multiplied to form a log-periodic structure, will result in an antenna having a frequency independent performance?

A. There are certain guidelines which are used, but there is no way of predicting with any degree of certainty

that a log-periodic structure will have frequency independent performance.

Q. Were these guidelines available at the time that Dwight Isbell developed his log-periodic [409] antenna—the one taught in PX-1?

A. Very few guidelines were available in those days.

Q. In your earlier answer were you referring to the time of Isbell's work or to the present?

A. I was referring to the present.

Q So that even today, if I may summarize your answer, there is no way of predicting.

A. There is no way of predicting, even today, with certainty.

Q. When did the work on frequency independent antennas start at the University, if you know?

A. Approximately the latter quarter of 1954.

Q. Has it stopped?

A. No.

Q. I take it then it is still going on today.

A. It is going on today.

[410] Q. How much attention was given to the development of log-periodic antennas during that period?

A. It was a significant portion of the total effort of our laboratory.

Q. How many successful log-periodic antennas were made at the University during the period from 1954 until today?

A. I would say ten or twenty.

Q. How many attempts were made?

A. Many.

Q. Could you give us a numerical approximation of what you mean by "many"?

A. Approximately 100, somewhere in that range.

Q. Dr. Mayes, I hand you a sheet which has been marked

as Plaintiff's Exhibit No. 30 for indentification and I ask you if you can identify it.

A. Yes. This is a pictorial representation of a log-periodic structure which was proposed as being a possible candidate for frequency independent antenna.

Q. By whom was the proposal made?

[411] A. Professor Rumsey.

Q. Where?

A. At the University of Illinois.

Q. Do you know when?

A. I believe in about 1957.

Q. Is this a log-periodic structure that was made?

A. Yes.

Q. Would you explain briefly how the repeating characteristic of a log-periodic structure is evident in this figure?

A. The figure shows a form of horn antenna in which the walls of the horn have been cut away. The rectangular shaped slots being produced by this process having a geometric relationship one to another on Exhibit 30, lines are shown which illustrate the boundaries of two cells on the structure and these cells would have dimensions which are related by a constant scale factor such as the factor Tau that we have previously discussed.

Q. So that as applied to this figure, Tau equal to constant is a fact?

A. Yes.

• • • • •

[412] Q. What is the component marked as "wave guide feed," Dr. Mayes?

A. This shows a portion of a rectangular conducting pipe which is known as a wave guide which would be used to collect the energy from the horn in case of a receiving antenna or to deliver energy to the horn in the case of a transmitting antenna.

Q. Is a wave guide equivalent to a twin wire transmission line or a coaxial cable?

A. In function, yes.

[413] Q. What is the significance of the word "signal" on the arrow on the right-hand side?

A. This shows the direction of arrival of the wave which would be impinging upon this horn for the purpose of using it as a receiving antenna.

Q. And what is the box marked "receiver" on the left-hand side?

A. This is a pictorial representation of the receiving equipment which would be used to collect the energy and process it as being received through the wave guide when this antenna is used as a receiving antenna.

Q. Dr. Mayes, did the antenna depicted in Plaintiff's Exhibit 30 have broad band characteristics?

A. Not to my knowledge, no.

Q. Do you know why it did not?

A. Not specifically.

Q. The fact is it did not?

A. It did not.

Q. Could it have been predicted that this antenna would not have wide band characteristics?

A. Not with certainly.

Q. Dr. Mayes, I hand you a sheet which has been marked as Plaintiff's Exhibit 31 for [414] identification and ask you if you can identify it?

A. This is a diagram which shows a type of logarithmic spiral antenna which was constructed and tested in the University of Illinois Laboratory in the early days of the investigation of frequency independent antennas.

Mr. Mann: Your Honor, I offer Plaintiff's Exhibit 31 for identification into evidence.

Mr. Rines: No objection, your Honor.

The Court: With no objection, Plaintiff's Exhibit 31

for identification may be admitted into evidence as Plaintiff's Exhibit 31.

(Said document heretofore marked Plaintiff's Exhibit No. 31 for identification, was received in evidence.)

By Mr. Mann:

Q. Would you describe in brief detail, Dr. Mayes, what the structure depicted in Plaintiff's Exhibit 31 is?

A. This is a conical logarithmic spiral where the spiral curve is of the same family as previous depicted in Plaintiff's Exhibit No. 45. However, [415] in this instance the spiral is developed on the surface of a cone rather than in a plane. The antenna is formed of a conductor which is then a portion of the surface of the cone which is outlined by the spiral curves and the antenna is connected to a transmission line at the small end of the structure, there also being a ground plane depicted at that end of the structure.

Q. Would you point out more specifically which element of the antenna structure is the ground plane?

A. The crosshatched portion of the diagram is the ground plane.

Q. That would be right at the top of the section marked "coaxial line"?

A. Yes.

Q. What is the function of a ground plane antenna structure of this type?

A. Many antennas are made to function in the immediate vicinity of the earth. This is a method of simulating the earth as far as the laboratory experimentation is concerned.

Q. What effect on the performance of the antenna does the ground plane have?

[416] A. Generally they are reflections of electromagnetic energy from the ground plane, it being a conducting structure.

Q. Is the reflection a mirror image type of reflection?

A. Yes.

Q. Would it therefore follow that the same performance would be obtained if a mirror image type of antenna was actually connected to the ground plane?

A. Yes, if the mirror image of the element above the ground plane were reproduced in conductor and appropriately located in the area below the ground plane, that antenna would function in the same way as this one in the presence of the ground plane.

Q. Do the arrows marked "signal" and the box marked "receiver" have the same significance as in the earlier exhibit, Plaintiff's Exhibit No. 30?

A. Yes, the same significance as in Plaintiff's Exhibit No. 30.

Q. Is this a log-periodic type of structure, Dr. Mayes?

A. Yes, it is.

[417] Q. Does the relationship Tau equals a constant apply to it?

A. Yes, and the boundaries of the cells are depicted in Plaintiff's Exhibit No. 31.

Q. Did this antenna exhibit broad band characteristics?

A. No, it did not.

Q. Could it have been predicted that it would not exhibit broad band characteristics?

A. No.

Q. I hand you a sheet which has been marked as Plaintiff's Exhibit No. 32 for identification and I ask you if you can identify it.

A. Yes. This is a diagram of another conducting structure which was built and tested in the antenna laboratory of the University of Illinois in the early investigations of frequency independent antennas.

Q. Are you familiar with the results obtained with this antenna?

A. Yes, I am.

Mr. Mann: I offer Plaintiff's Exhibit 32 for identification into evidence.

Mr. Rines: No objection, your Honor.

[418] The Court: With no objection, Plaintiff's Exhibit 32 for identification may be admitted into evidence as Plaintiff's Exhibit 32.

(Said document heretofore marked Plaintiff's Exhibit No. 32 for identification was received in evidence.)

By Mr. Mann:

Q. Would you describe the structure depicted in Plaintiff's Exhibit 32, please, Dr. Mayes?

A. This is another logarithmic spiral antenna where the boundaries of the antenna conductor are described by logarithmic spirals which are developed on the surface of two cones having slightly different cone angles. The region between these two curves on a surface which is everywhere parallel to the ground plane also depicted here with the crosshatched lines is parallel to this ground plane.

Q. What is the crosshatched relatively thick bar at the top of the coaxial line at the bottom of the figure?

A. This is the ground plane.

Q. Does it function as the ground plane you described in connection with the earlier exhibit?

[419] A. In the same manner.

Q. And the receiver and the signal have the same significance as previously?

A. Yes.

Q. Did this antenna structure exhibit broad band characteristics, Dr. Mayes?

A. No.

Q. Is it a log-periodic structure?

A. Yes.

Q. Could it have been predicted that it would not exhibit broad band characteristics?

A. No.

[420] Q. Dr. Mayes, I hand you a sheet which has been marked Plaintiff's Exhibit 34 for identification and ask if you will identify it, please.

A. Yes. That is a pictorial representation of an antenna which was built and tested in the University of Illinois Antenna Laboratory in the early days of the research on log-periodic structures.

Mr. Mann: I offer Plaintiff's Exhibit 34 for identification in evidence, your Honor.

Mr. Rines: No objection.

The Court: With no objection, Plaintiff's Exhibit 34 for identification may be admitted into evidence as Plaintiff's Exhibit 34.

(Said document heretofore marked Plaintiff's Exhibit 34 for identification, was received in evidence.)

By Mr. Mann:

Q. Dr. Mayes, will you describe the structure shown in Plaintiff's Exhibit 34?

A. Yes. This structure is formed from a cone which is filled with conducting material, in which a number of grooves have been cut in a manner such that the grooved geometry corresponds to the log-periodic.

[421] Q. Is it therefore a log-periodic structure?

A. Yes.

Q. Does the ground plane operate in the same manner as you have previously discussed?

A. Yes.

Q. And the receiver has the same significance?

A. Yes.

Q. The signal direction?

A. Yes.

Q. Did this antenna exhibit broad band characteristics?

A. No.

Q. Could it have been predicted that it would not exhibit broad band characteristics?

A. No.

Q. Dr. Mayes, I hand you a sheet marked Plaintiff's Exhibit 36 for identification and ask if you can identify it?

A. Yes. This is a schematic diagram showing a type of log-periodic structure which was constructed and tested in the University of Illinois Antenna Laboratory [422] in the course of the frequency independent antenna project.

Q. Are you familiar with the work on this antenna?

A. Yes, I am.

Mr. Mann: I offer Plaintiff's Exhibit 36 for evidence into evidence, your Honor.

Mr. Rines: No objection.

The Court: With no objection, Plaintiff's Exhibit 36 for identification may be admitted into evidence as Plaintiff's Exhibit 36.

(Said document heretofore marked Plaintiff's Exhibit 36 for identification, was received in evidence.)

By Mr. Mann:

Q. Would you describe the structure depicted in this exhibit, please, Dr. Mayes?

A. This exhibit shows a number of linear dipoles which are arrayed in a log-periodic fashion and which are all connected to a two-wire transmission line, the lengths of line between adjacent dipoles being somewhat longer than the spacing between the dipoles, and all the dipoles—or I should say dipole halves [423] on one side of the array—are connected at their inner ends to the same conductor of the transmission line.

Q. To what extent is this structure similar to the antennas shown in Isbell patent PX 1?

A. In so far as the array of dipoles is concerned, it is identical with that shown in Plaintiff's Exhibit PX 1.

Q. Are there any differences?

A. Yes.

Q. Would you explain the differences?

A. The transmission line in this instance is not transposed between adjacent dipoles. The transmission line length, in contrast to that shown in Plaintiff's Exhibit PX 1, is not the same as the spacing between adjacent dipoles.

Q. Is this a log-periodic structure?

A. Yes, it is.

Q. Would you point out for the Court what constitutes the cell in this structure?

A. The cell in this structure is composed of a single dipole and the length of transmission line between that dipole and the next adjacent dipole.

[424] Q. Does the relationship Tau equal a constant apply to this structure?

A. Yes, it does.

Q. Does it apply in the same manner as that in which Tau equals a constant applies to the antennas shown in the Isbell patent, PX 1?

A. Yes, it does.

Q. Did this antenna exhibit broad band performance characteristics?

A. No, it did not.

Q. Could it have been predicted that it would not?

A. No.

Q. Dr. Mayes, I have handed you a single sheet which has been marked Plaintiff's Exhibit 37 for identification and ask if you can identify it.

A. Yes. This is a pictorial representation of an antenna structure which was built and tested in the University of Illinois Antenna Laboratory in the course of an investigation of log-period antennas.

Q. When

A. Several models of this antenna have been constructed over a rather long period of time. I would say that the first attempts were made about 1960, [425] and further

attempts to obtain satisfactory performance of this antenna have continued up until just a few weeks ago.

Q. So that this antenna represents an attempt at the University after the Isbell invention was made.

A. Yes.

Q. The Isbell antenna was developed.

A. Yes.

Mr. Mann: Your Honor, I offer Plaintiff's Exhibit 37 for identification in evidence.

Mr. Rines: No objection.

The Court: With no objection, Plaintiff's Exhibit 37 for identification may be admitted in evidence as Plaintiff's Exhibit 37.

(Said document heretofore marked Plaintiff's Exhibit 37 for identification, was received in evidence.)

By Mr. Mann:

Q. Would you describe the structure shown in Plaintiff's Exhibit 37, please, Dr. Mayes?

A. Yes. This exhibit shows a number of conducting rods which are placed vertical with respect to a ground plane but are insulated therefrom by dielectric [426] spacers between the rods and the ground plane itself. The rods are arrayed along a straight line, and their length and spacing is chosen to correspond to that described as log-periodic structure.

Q. This then is a log-periodic structure?

A. This is a log-periodic structure.

Q. What is the cell in this structure?

[427] A. The cell in this structure is a single rod plus the length of wire which is used as a feed line for the structure which is depicted in this drawing as a sinuous feeder.

Q. Does the ground plane function in the same manner as you have previously described?

A. Yes.

Q. Is that also true of the receiver and the signal direction?

A. Yes.

Q. Did this structure exhibit broad band performance characteristics, Dr. Mayes?

A. No, it did not.

Q. Could it have been predicted that it would not?

A. No; it could not have been predicted with certainty.

Q. Dr. Mayes, I hand you a sheet marked Plaintiff's Exhibit 38 for identification and ask if you can identify it.

A. Yes. This is a pictorial diagram of an antenna structure which was built and tested in the Antenna Laboratory at the University of Illinois [428] in the course of an investigation on log-periodic structures.

Q. When?

A. This antenna was built some time in the period between 1959 and 1963—I am not sure exactly when in that period.

Mr. Mann: I offer Plaintiff's Exhibit 38 in evidence, your Honor.

Mr. Rhines: No objection, your Honor.

The Court: With no objection, Plaintiff's Exhibit 38 for identification may be admitted into evidence as Plaintiff's Exhibit 38.

(Said document heretofore marked Plaintiff's Exhibit 38 for identification, was received in evidence.)

By Mr. Mann:

Q. Would you describe the structure shown in Plaintiff's Exhibit 38, please, Dr. Mayes?

A. Yes. This is another type of log-periodic structure employing conducting rod elements over a ground plane. This differs from Plaintiff's Exhibit 37 principally in the way in which the feed line which connects all of these con-

ducting rod elements is constructed. In the present instance of Plaintiff's [429] Exhibit 38, the feed line is wound on a dielectric core in the manner of a logarithmic spiral.

The dielectric core is supported above the ground plane with insulating spacers.

Q. Is the significance of the receiver, the signal direction, and the ground plane similar to that you have previously described?

A. Yes.

Q. Do the dipole elements shown in this exhibit satisfy a requirement Tau equals the constant?

A. I would refer to these elements as monopoles rather than dipoles, but they do satisfy the log-periodic geometry requirements.

Q. Is that also true of the spacing between monopoles?

A. Yes.

Q. You have testified, have you not, that this is a log-periodic structure?

A. It is a log-periodic structure.

Q. Did this structure exhibit broad band performance characteristics?

[430] A. No, it did not.

Q. Was it predictable that it would not?

A. No.

[430] Q. Dr. Mayes, I hand you a textbook. Are you familiar with this textbook?

A. Yes, I am.

Q. Would you identify it, please?

A. This is an antenna engineering handbook which is edited by Henry Jasik and published by McGraw-Hill Publishing Company.

Q. It that considered an authoritative textbook?

A. Yes, it is.

Q. I ask you, please, to turn to Page 18-13 and read aloud the paragraph at the bottom beginning:

"It should be pointed out that many types—" and so forth.

A. It should be pointed out that many types of log-periodic structures are not broad band because of either extreme variation over a priod or a severe end effect which destroys the periodicity of the electrical characteristics. Only the successful structures are described herein. Unfortunately it is not possible to determine a priori the frequency independent types of log-periodic antennas."

Q. Now, Dr. Mayes, do you agree with that [432] statement?

A. Yes, I do.

Q. Are you familiar with the difficulties which the excerpt which you have read refers to, specifically extreme variations over a period or severe end effect?

A. Yes, I am.

Q. Would you explain that in a little detail for the Court, please?

A. As we indicated in the drawing, Plaintiff's Exhibit 45, it is not physically possible to continue this structure to vanishingly small dimensions, nor to extremely large dimensions; therefore, there are necessarily truncations of the structure which must be introduced into the geometry in both the spiral configurations and the log-periodic configurations in order to make a practical antenna structure.

One of the difficulties which one is faced with then in achieving the frequency independent performance arises from the possibility that energy which is introduced into the structure at terminals located at the small end will, in fact, reach the large end of the structure and be [433] reflected from it. This effect which arises from such reflections is called the end effect.

There are some log-periodic structures which have severe end effect; there are others which have negligible end effect.

Q. Excuse me. Let me interrupt you at that point.

Is it possible to predict what type of cell structure will have negligible end effect or substantial end effect?

A. Not with certainty.

Q. What do you mean by "not with certainty"?

A. There are some guidelines that you might use to try to predict but these are not infallible.

The Court: Mr. Mann, we will take a brief recess.

(Brief recess.)

[434] The Court: Will you continue, please, with your direct examination of this witness?

By Mr. Mann:

Q. Dr. Mayes, I believe that you were explaining to the Court some of the difficulties encountered in designing log-periodic antennas. I believe you were discussing end effect, is that correct?

A. Yes.

Q. Would you continue with your testimony?

The Witness: I wonder if I could have the reporter read back the last part of the testimony so that I might—

The Court: Yes.

(Record read by the reporter.)

The Court: Yours is the next move. Ask another question.

By Mr. Mann:

Q. Would you explain the significance of variation over a period, Dr. Mayes?

A. Yes. There are possibilities that even though a structure has log-periodic geometry, the nature of a single cell in that structure may be such that the important electrical characteristics [435] of the antenna do not remain fixed even over a band of frequencies which is related in the

manner such that one limit frequency is the scale factor Tau times the other limit frequency.

Q. What do you mean by "limit frequency" in this context?

A. These are the frequencies which would be the end points on a portion of the frequency spectrum which is referred to as log-period.

The two frequencies which define that portion of the spectrum would be related by the scale factor of the structure—in other words, the constant Tau for that particular structure.

Q. Would you refer, Dr. Mayes, to the sketches which we have introduced showing unsuccessful log-periodic structures and select from those those antenna arrays which use dipoles or monopoles.

Would you identify those?

A. Yes. Plaintiff's Exhibit 38 employs monopoles in a log-periodic array; Plaintiff's Exhibit 37 also employs monopoles; Plaintiff's Exhibit 36 employs dipoles.

[436] Q. In those structures which employ monopoles, what is the effect of the ground plane?

A. The effect of the ground plane is to prevent electromagnetic energy from existing in the portion of the space which is on the opposite side of the ground plane from the monopoles themselves. The ground plane forms an effective mirror for that energy, and the performance of these monopole arrays in the space above the ground plane is the same as would be observed from supplying the mirror image of the structure in place of the ground plane.

Q. In effect forming a dipole?

A. In effect forming a dipole or an array of dipoles.

Q. All of these antennas did not exhibit broad band characteristics, is that not correct?

A. You are speaking of the—

Q. The ones you have just identified.

A. —these three exhibits, Plaintiff's Exhibits 36, 37, and 38.

Q. Yes.

A. That is correct.

[437] Q. Prior to the development of the log-periodic dipole array by Dwight Isbell, had anyone ever successfully designed or built a log-periodic antenna structure in which dipoles or monopoles were used, and by "successful"—

Mr. Rines: I object, your Honor. I don't think the question of anyone—I don't think the witness knows about anyone. To his knowledge.

By Mr. Mann:

Q. To your knowledge, of course.

A. Not to my knowledge.

The Court: Within your knowledge, yes. That is right.

By the Witness:

A. Not to my knowledge.

By Mr. Mann:

Q. Had I completed my question at the time? May I have my question back. I think I was cut off before I quite finished it.

(The reporter read the question.)

By Mr. Mann:

Q. At that point, by "successful" I meant [438] successful in achieving broad band performance, Dr. Mayes.

A. There were no successful log-periodic dipole or monopole arrays that I am aware of—

Q. Prior—

A. —before that developed by Isbell.

Q. Dr. Mayes, do you have any knowledge of the extent to which log-periodic antennas have been put to practical use?

A. Yes.

Q. Would you describe what you know of such use?

A. There have been a number of applications of log-periodic antennas. Was the question directed toward dipole arrays specifically?

Q. Not yet. No.

A. Just all types of log-periodic antennas.

Q. Yes.

A. They have been widely used my the military in various military systems; they are in wide use in the high frequency communications services, both military and commercial; and they have been extensively [439] employed in the consumer market, primarily with regard to television and FM radio reception.

Q. Now, let me restrict my question to log-periodic dipole arrays in particular. What commercial or other practical uses have been made of log-periodic dipole arrays?

A. Dipole arrays have been employed in all of these arrays which I mentioned in the answer to the previous question.

Q. You mentioned certain consumer products. What are these products?

A. Antennas for the reception of television signals have been developed which employ log-periodic dipole arrays; also antennas for the reception of FM radio broadcasts have been developed using the log-periodic dipole array.

Q. What characteristics of log-periodic dipole arrays render them suitable for use as commercial television antennas?

A. The uniformity of the performance over relatively wide band of frequencies, and this performance is displayed in a number of characteristics which are very desirable for both the television and FM radio [440] service. The antennas have a well formed directional characteristic; the pattern is unidirectional with a high ratio of response in one

direction to that in the opposite direction; the antennas have input impedance which is very nearly constant as a function of frequency. The antennas have a high efficiency which produces a high level of signal output for a given level of applied field. They are simple to construct and therefore economical as far as mass production techniques are concerned.

[441] Q. Why is uniform gain a significant consideration in the use of any antenna for television reception?

A. The television broadcast signal is composed of many components which are distributed across a band of frequencies which is six megacycles wide. In particular the color television signal is composed of a number of components which are displaced within the six megacycle band.

Q. Excuse me. What is composed of a six megacycle band?

A. The portion of the spectrum on which any one television broadcasting station operates is six megacycles wide.

Q. I believe you interrupted your answer. You were explaining why uniform performance is significant over a channel.

A. Yes.

For the faithful reproduction of the broadcast signal, it is important that the television receiver obtain this signal with these various components in the same relative magnitude that they were transmitted. This requires that the gain of the television receiving antenna [442] not change appreciably over the channel band width, the six megacycles of the transmitting station.

Q. What is the performance of a log-periodic dipole array with respect to gain over a six megacycle channel?

A. It is very nearly constant.

Q. You mentioned constant impedance, Dr. Mayes. Why is it significant in television receiving antennas?

Perhaps as an introduction you might define briefly what

is meant by impedance. I believe it has been mentioned before.

A. This is a way in which it is possible to evaluate how much of the energy the antenna receives is actually delivered to the transmission line and hence can find its way to a receiver. If the impedance is not stable with frequency, then the gain of the antenna will not be stable with frequency; that is to say, the amount of signal which is delivered to the transmission line or to the receiver will change as the frequency is varied.

Q. Referring back for a moment to uniform [443] gain, Dr. Mayes, what is the observable effect of non-uniform gain on a television screen?

A. It is particularly severe with respect to color television where the various hues on the screen may be changed from one color to another and there could possibly be smearing of the figures on the television screen.

• • • • •

[456] DR. RAYMOND H. DU HAMEL, called as a witness by and on behalf of the plaintiff in rebuttal, having been first duly sworn, was examined and testified as follows:

Direct Examination by Mr. Marshall.

Q. May I have your full name and address, Dr. DuHamel?

A. Raymond H. DuHamel, 2021 Yucca Avenue, Fullerton, California.

The Court: May I have the spelling of your name?

The Witness: D-u H-a-m-e-l.

By Mr. Marshall:

Q. Dr. DuHamel, I show you what has been marked for identification as Plaintiff's Exhibit No. 50 and I ask you if you can identify that document, please.

A. Yes, sir. This is information I supplied. It is a resume of my past experience and includes a list of my publications and patents that are assigned to me.

Mr. Marshall: Your Honor, I would like [457] to offer into evidence Plaintiff's Exhibit No. 50.

Mr. Rines: Your Honor, we haven't seen this until just now. May I look at it, please?

The Court: Oh, yes.

[458] May I inquire, your Honor, for what purpose this is being put in evidence?

The Court: If you didn't, I would, because it is a very extraordinary kind of exhibit. I observe that Plaintiff's Exhibit Number 50 for identification is seemingly a resume of biographical data of the witness. In ordinary circumstances that kind of information isn't given in writing.

I have no objection to taking it that way, but if there is objection, I must listen to it.

The purpose is—

Mr. Marshall: Your Honor, the purpose is merely to expedite the testimony of Dr. DuHamel and save the time of the Court, because Dr. DuHamel will merely testify as to the information which is contained hereon.

The Court: I have never had it done that way, but if there is no objection—

Mr. Rines: No objection.

The Court: With no objection, Plaintiff's Exhibit 50 for identification may be admitted into evidence as Plaintiff's Exhibit 50.

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[461] Q. Dr. DuHamel, in Plaintiff's Exhibit Number 50 it is stated that you worked for the Collins Radio Company from 1956 to 1961. Approximately what time in 1956 did you go to work for Collins Radio?

A. November of 1956.

Q. While at Collins Radio, Dr. DuHamel, the exhibit

refers to work which you did in research and development relating to log-periodic antennas, is that correct?

[462] A. Yes.

Q. During what period of time did you work in the field of research and development relating to log-periodic antennas?

A. At Collins Radio?

Q. Yes, sir.

A. From, the time I joined there until I left, which was in early '61.

Q. I see.

In 1957, Dr. DuHamel, were you supervising the work of others in the field of log-periodic antennas?

A. At that time I was supervising about five engineers, and one of them in early '57 was working on log-periodic antennas.

• • • • •

[463] Q. Dr. DuHamel, do you understand what is meant by the term "log-periodic antennas"?

A. Yes.

Q. Would you please give us your understanding?

A. I understand it as the antenna structure which is defined by angles to a certain extent; and for any lengths or distances that are involved in the structure, the lengths or distances of similar parts of the antenna form a geo-

[464] metric sequence and the ratio of adjacent numbers in this geometric sequence is a constant, naturally, and is usually designated by Tau.

Q. During your work at Collins Radio were any log-periodic antennas constructed by you which employed this definition or your understanding of what log-periodic antennas is which did not function as log-periodic antennas?

Mr. Rines: Objection, your Honor. I don't see that there is any relevance to that question.

The Court: I will sustain the objection.

By Mr. Marshall:

Q. Dr. DuHamel, during your work at Collins Radio, did you construct log-periodic structures?

A. Many different kinds; many, many.

Q. Dr. DuHamel, I show you what has been marked for identification as Plaintiff's Exhibit Number 51 and ask you if you can identify the exhibit which has been so marked.

A. Yes. This is a copy of some sketches that I drew myself.

Q. Would you please further elaborate on the [465] description of them for the purposes of identifying the Plaintiff's Exhibit for identification?

A. Well, these are sketches of log-periodic structures which we had hoped that would perform as good antennas but which did not.

Q. That is sufficient.

Mr. Marshall: Your Honor, I would like to introduce into evidence Plaintiff's Exhibit Number 51.

Mr. Rines: Objection, your Honor, and I move that the testimony relating to this exhibit be stricken. We have never been shown this exhibit before, and we don't know what relevance or materiality it has in addition—

The Court: I quarrel with the identification. The witness says this represents something that he hoped would do as well as something else but did not. I am paraphrasing what he said.

Mr. Marshall: Yes, exactly.

The Court: What is the materiality?

Mr. Marshall: Well, your Honor, the materiality of this is that these are—and I am again referring to what has been marked as Plaintiff's Exhibit [466] Number 51 for identification—sketches of structures which Dr. DuHamel, while at Collins Radio, in fact constructed, and the purpose of the proffer of the evidence is for Dr. DuHamel to testify as to each of the specific structures which are so

sketched and to discuss whether they did or did not work as log-periodic antennas. In other words, to describe their structure in terms of the log-periodic concept or log-periodic structures and to testify as to whether or not these, although conforming to log-periodic structures, did not work. It goes, your Honor, to the empirical nature of the log-periodic principle and the question of unobviousness of the invention.

The Court: It took you a long time to get around to the reason for the offer. The last thing you said is the purpose.

Mr. Marshall: Yes, your Honor.

Mr. Rines: Your Honor.

The Court: Counsel.

Mr. Rines: This witness is being offered, your Honor, in rebuttal. According to Mr. Marshall's statement, these purport to be antennas that Mr. [467] DuHamel tried. These are not the antennas of the present invention—present patents in suit. This is not Mr. Isbell's antenna or Mayes and Carrel's antenna, and I think it is highly irrelevant and immaterial whether any other antennas were or were not obvious.

The Court: Rebuttal testimony, it seems to me, must relate to the testimony of the defense, Mr. Marshall.

[468] The Court: I think there is a grave question about the admissibility of this kind of evidence on rebuttal.

Mr. Marshall: Your Honor, it does to the question of obviousness. The defendant has pleaded that this is obvious.

The Court: All right. I will overrule the objection of the defendant and take the exhibit in, but I tell you you must limit your direct examination to the matter of obviousness. With that limitation, and over the objection of the defendant, the Court will admit Plaintiff's Exhibit 51 for identification into evidence as Plaintiff's Exhibit 51.

(Said document heretofore marked Plaintiff's Exhibit No. 51 for identification, was received in evidence.)

By Mr. Marshall:

Q. Dr. DuHamel, referring to Plaintiff's Exhibit 51 and what has been marked as Page 1 of that exhibit, would you please refer to the item marked "No. 1. Capacitive 'U-loading' of dipole array."

Would you please describe that [469] antenna to the Court in terms of your understanding of log-periodic structures?

Mr. Rines: Objection, your Honor. There is absolutely nothing in the defendant's case that bears upon a capacitive U-loading of dipole array as to any issue of obviousness. This would not have any relevance whatsoever.

Mr. Marshall: Your Honor, during the course of Mr. Rines' examination of the various witnesses, he referred indirectly to the Winegard decision and was quoting—or not quoting, he referred to a log-periodic principle of antenna design. It is our position that there is no such theory or design of antennas, and in order to prove that there is no such theory of design, that one cannot, using the theory of log-periodicity, predict merely from that theory alone as to whether or not the structures are or are not going to work. In other words, one can prepare a structure conforming with the log-periodic theory so far as the structure is concerned and not be able to predict whether it will work or not. This clearly goes to the question of obviousness.

The Court: I remember the reference made by [470] Mr. Rines. My impression is that what you are seeking to prove here perhaps can be proven. I have grave doubt as to whether the question asked when answered would represent the best evidence. For example, on Plaintiff's Exhibit No. 51 the first line on the first page of the exhibit reads this way:

"LP antennas which did not work."

Well, they did not work for him, I take it.

Mr. Marshall: That is right, your Honor.

The Court: Meaning the witness. Does that mean they wouldn't work for anybody? I don't know.

Mr. Marshall: He is one skilled in the art, your Honor, and I believe would have been able to modify them to make them work.

The Court: I will let him answer over objection. I repeat, I have grave doubts about whether or not this is the best evidence of what you seek to prove.

Mr. Marshall: Would you read the question?

(Question read by the reporter.)

By the Witness:

A. This antenna satifies all of the design principles of log-periodic structures or antennas [471] which we have been using. I would like to point out that there is a slight difference in nomenclature. I call any log-periodic structure which we try to use as an antenna an antenna.

The Court: I wish you would raise your voice. I am going to have to read what you say at some future time and I want the reporter to have it accurately down on paper.

By the Witness:

A. I said there is a slight difference in nomenclature between me and others here in that I refer to any periodic structure as an antenna whether it works properly or good or not, and so in this sense I have called these log-periodic antennas.

The first antenna is a modification of the Isbell dipole array for which it was hoped that we could obtain a smaller mechanical structure for the same low frequency limit of operation.

By Mr. Marshall:

Q. Did this antenna work, Dr. DuHamel?

A. No, it did not. I had predicted that it would but it did not. It had very poor pattern and [472] impedance characteristics.

Q. I refer you in the interest of expediency to the other sketches which you have prepared here on Plaintiff's Exhibit No. 51 and ask you if they represent sketches of antennas which were constructed by you—strike that question.

Do these sketches which are shown on Plaintiff's Exhibit No. 51, pages 2 through 8, represent other structures which were constructed by you?

A. Which were constructed by me or my—

Mr. Rhines: Objection.

The Witness: Pardon me.

The Court: I didn't hear it. Did you object?

Mr. Rines: I said I have the same objection, your Honor.

The Court: I will overrule the objection. I will let him answer.

By the Witness:

A. These antennas were constructed either by me or people working for me at Collins or the University of Illinois.

• • • • •

[473] By Mr. Marshall:

Q. Dr. DuHamel, do you know the manner in which the actual antennas which are shown by the sketches shown in Figures 2 through 8 were constructed?

A. Yes.

Q. In what manner were they constructed?

A. With wires and tubes and by technicians soldering the parts together. They were constructed according to log-periodic antenna principles.

• • • • •

Q. Dr. DuHamel, did any of these [474] antennas which you have sketched out in Sketches 2 through 8 of Plaintiff's Exhibit No. 51 function as a log-periodic antenna?

A. No, they did not—or, that is, they did not exhibit good band width characteristics with regard to the patterns, radiation patterns and input impedance.

Q. Would you have been able to predict, Dr. DuHamel, as to whether or not these antennas would have functioned as log-periodic antennas prior to constructing and testing them?

A. No.

Q. I show you what has been introduced into evidence as Plaintiff's Exhibit No. 1. Are you familiar with that exhibit? Would you please examine it and advise the Court as to whether or not you are familiar with that exhibit?

A. Yes, I am familiar with it.

Q. I refer you to Fig. 1 of Plaintiff's Exhibit No. 1 as well as Fig. 2—strike that.

Initially, Dr. DuHamel, I refer you to Fig. No. 1 of Plaintiff's Exhibit No. 1 and ask you when you first learned of the structures which are shown in Fig. 1.

[475] A. I first learned of this log-periodic antenna from Dwight Isbell early in 1959 by telephone conversation and a little bit later by personal discussion at the New York International, IEEE meeting, and that was in March of 1959.

Q. I also refer you to Fig. 2 of Plaintiff's Exhibit No. 1 and ask you when you first learned of this structure which is shown in Fig. No. 2.

A At the same time as the other.

Q. Prior to this time, Dr. DuHamel, did you ever construct any antenna array such as shown in Figures 1 or 2 of Plaintiff's Exhibit No. 1?

A. No, I did not.

Mr. Rines: Prior to what time?

Mr. Marshall: Prior to the time he testified to, Mr. Rines; prior to when he first learned of it.

And your answer, Dr. DuHamel?

The Witness: No, we did not construct any antennas similar to these shown here.

• • • • •

[476] Q. Do you know of anyone other than Dr. Isbell who constructed antennas shown in Figures 1 and 2 prior to the time at which you learned of it?

A. No.

Q. Why did you not construct any such arrays prior to this time, Dr. DuHamel?

• • • • •

[480] A. We did not resign this antenna because the design principles which we were working on did not make this an obvious result.

Q. Now, when you refer to "this," what do you mean, Dr. DuHamel?

A. The Isbell configuration; the Isbell antenna.

Q. What were the design principles that you were working on at that time that you just referred to, Doctor?

[481] A. There were what we called three design principles—the angle concept, the log-periodic configuration concept, and the complementary condition for log-periodic structures. The complementary condition proved to not be a necessary condition in our later work, but we were still led by this to some extent in designing the log-periodic antennas that we did design.

Q. What do you mean by "complementary concept"?

A. This applies to a planar antenna structure made of sheet metal with holes in it, and the complementary structure to that sheet is obtained by replacing the air with metal and the metal with air.

A self complementary structure is one for which the complement and the original structure are identical.

Q. Just so I will understand this as well as the court, Dr. DuHamel, you mentioned that there were three concepts of design that you were talking about, the complementary concept being one. Now, what was the second one?

A. The log-periodic concept whereby you design the antenna and all the dimensions so that the [482] electrical performance must repeat periodically with the logarithm of frequency. This implies that the antenna is made of cells which are similar but are not of the same size and that adjacent cells are rpresented by some factor, some constant factor, Tau.

Q. What was the third concept that you were talking about or referred to?

A. The angular concept which Professor Rumsey introduced, but actually it is included in the log-periodic concept, so there are really basically only tow concepts, although our first paper mentioned three concepts.

Q. When you first learned of the Isbell antennas which are shown in Figure 1 and Figure 2 of Plaintiff's Exhibit No. 1, were you surprised that they worked?

A. I was quite surprised at the simplicity of the structure, and my pride was a little bit hurt in that I had not thought of it, too, or first.

Mr. Marshall: Would you read the question back, please.

(The reporter read the question.)

[483] By the Witness:

A. At first I was somewhat surprised that they worked, but after thinking more about it and thinking back, then I was not surprised. At first I was surprised that it did work.

By Mr. Marshall:

Q. Dr. DuHamel, I show you what has been marked for identification as Plaintiff's Exhibit Number 55 and ask you if you will describe what has been so marked.

A. This is a copy of a chapter of the "Antenna Engineering Hand Book," which I was co-author of.

* * * * *

[493] Q. Dr. DuHamel, referring to Column 2 of Defendant's Exhibit No. 14, Lines 51 through 53, would you please describe the work, if any, that you did in investigating the angle which is [494] set forth therein?

The Court: I will consider that you object to the question, Mr. Rines, and I overrule your objection.

Mr. Rines: Thank you, your Honor.

By the Witness:

A. Obviously physically the angle can be adjusted from zero to 180 degrees. Practically we want to know how this angle affects the performance of the antenna.

By Mr. Marshall:

Q. Before going any further, Dr. DuHamel, my question was what did you do in investigating this angle? I would like to have that answer first.

A. We measured radiation patterns and input impedance as a function of that angle.

Q. Now what was the scope of the angle that you actually investigated?

A. Actually about the minimum angle we worked with was seven degrees and the maximum angle was 180 degrees.

Q. You said you—

A. May I correct that?

Q. Yes.

[495] A. My memory is not too clear in that we may have looked at smaller angles, but we did investigate the whole wide range of angles, not all the way down to zero.

Q. You say that it was about seven degrees was the smallest that you tested?

A. About seven degrees was about the minimum angle for which we could get good radiation pattern, input im-

pedance on several of these types of structures described in the figures. On the antenna of Fig. 4, the performance was quite bad for psi angles less than seven degrees.

Q. You are referring to Defendant's Exhibit No. 14, is that correct?

A. Yes.

• • • • •

[499] Q. Dr. DuHamel, again referring to the commercial antennas which were manufactured and sold by the Collins Radio Company, which you just described, and with reference to—then you referred to Fig. 7 and Fig. 4, is that correct?

A. Yes.

Q. Will you please tell the Court the angle at which the elements were related each to the other in such commercial antennas.

Mr. Rines: Same objection, your Honor, on the matter of relevancy and materiality.

The Court: What is the purpose?

Mr. Marshall: Your Honor, I first of all want to show that as of a given period of time, this was the commercial antennas which were being manufactured and sold by the Collins Radio Company.

The Court: How would it help me to decide this case in any aspect by getting the angle—getting the witness to answer what angle?

Mr. Marshall: I wanted to show, your Honor, [500] what the structure was, because then I wanted to equate this type of structure with what was the subsequent structure that they used. The angle, your Honor, is specific to the structures that we were talking about.

The Court: I will let him answer over objection. I doubt that the answer would have any probative value. It can't harm the defendant, in any event. I will let him answer, as I say, over objection.

[501] By the Witness:

A. The psi angle was approximately 60 degrees.

By Mr. Marshall:

Q. 60 degrees?

A. For the 237-A antenna of which we sold approximately 200.

Q. Now which antenna is that that you are referring to?

A. That is the one in Fig. 7.

The Court: The lawyers are having difficulty hearing you, sir. I can't blame them.

Mr. Rines: Would the reporter please read that answer.

The Court: Read the answer for Mr. Rines.

(Record read.)

By Mr. Marshall:

Q. Did you ever change the design of the log-periodic antennas which Collins Radio was manufacturing and selling?

A. Yes, after they—

Q. Just answer yes or no, Doctor.

A. Yes.

Q. When was such change made, Doctor?

A. After we learned of the Isbell log-periodic [502] dipole array.

Q. Would you then describe the type of structures that were manufactured and sold by the Collins Radio?

A. We developed a new antenna incorporating Isbell's design. This antenna was termed the 237-B antenna.

Q. Did you discontinue the other type of design which you had previously referred to?

A. No, we kept selling both of them.

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[502] *Cross-Examination by Mr. Rines.*

Q. Dr. DuHamel, what is the nature of the arrangement that you have with the University of Illinois Foundation in connection with receiving a share of royalty payments for all log-periodic antennas that they license?

Mr. Marshall: I object to this question, your Honor.

The Court: Why?

Mr. Marshall: It is going beyond the scope [503] of the direct examination.

The Court: Oh, it shows interest. I overrule the objection. If, indeed, he has any arrangement—I agree that there was no arrangement testified about, but if he has one, it may be that there is an interest.

I will let him answer over objection.

By the Witness:

A. I would receive one-ninth of twenty percent of the royalty. I think this is the correct number.

By Mr. Rines:

Q. This would be on antennas licensed under the Isbell and Mayes and Carrel Patents in suit?

A. Yes.

Q. Do you know if Mr. Mayes receives a similar return?

Mr. Marshall: I object to that question.

The Court: That wouldn't be the best evidence. I sustain the objection.

By Mr. Rines:

Q. Would you please refer to your sketches on Plaintiff's Exhibit No. 51 and would you tell his Honor whether it is not the fact that you did [504] succeed in making antennas of one or more of the geometrical configurations shown in Exhibit 51 ultimately work by modifying the same?

A. If I may take them one at a time—

Q. Please.

A. That listed as No. 1, as far as I know it is not possible to make it work. We never made it work.

Q. Can you tell his Honor why it is not possible for that to work?

Mr. Marshall: Your Honor, that is conjectural on the part of the witness answering as to why it was not possible. This is a very speculative question.

Mr. Rines: Your Honor, the witness said it was not possible; I didn't say that.

The Court: Suppose you reframe the question. If you would like to ask the witness why he was not able to make it work, I will let him answer that.

Mr. Rines: All right.

By Mr. Rines:

Q. Would you please tell his Honor why you were not able to make the antenna shown in Sketch 1 [505] of Plaintiff's Exhibit 51 work?

A. I cannot explain that because I did not understand the theory of these exactly and all that I can rely on is experimental evidence.

Q. On what basis did you come up with Sketch 1, Plaintiff's Exhibit 51? What was the reason that you thought that this should be tried?

A. I performed an analysis of the characteristic impedance and "Q" of these U-loading elements as well as several other types of loaded elements, and this appeared to have the best characteristics for a reduced size antenna which this was supposed to be.

Q. Were these mathematical calculations?

A. These were mathematical calculations of the individual folded U dipoles of the array, but they did not take into account the whole dipole array configuration. It did not.

Q. Would it be fair to say that you built this after only considering one element but not the mathematics of what happens when you put the group of elements together?

A. I don't quite understand that question.

[506] Q. Do I understand your answer to be that your mathematical analysis was in connection with one of these U dipoles and that you did not perform a mathematical analysis of an array of these U dipoles as shown in Sketch 1 of Plaintiff's Exhibit 51?

A. This was not done because we did not have the time or money available to do that.

Q. The answer is you did not make a mathematical analysis of the antenna shown in Sketch 1 of Plaintiff's Exhibit 51 before testing?

A. I did not make a complete mathematical analysis of it.

Q. Would the same answer apply to each of Sketches 2 through 8 of Plaintiff's Exhibit 51?

A. Yes.

Q. Would you please turn to Sketch No. 3 in Plaintiff's Exhibit 51. You have characterized this, Dr. DuHamel, as a wire trapezoidal tooth. Will you point out where is the tooth?

A. That is poor nomenclature and it was used because all we had done on this compared to the wire trapezoidal tooth structure was to remove the central supporting element.

[507] Q. What central supporting element?

A. That we had used with wire trapezoidal tooth antennas.

Q. Oh, prior to trying the antenna shown in Sketch 3 of Plaintiff's Exhibit 51, you had tested the same antenna with a central wire running up the center of the top and bottom halves?

A. Yes. This was reported in the paper by Fred Ore and myself.

[508] Q. Would you please turn to Page 18-12 of Plaintiff's Exhibit No. 55. That is the Jasik Handbook.

A. Page 12?

Q. 18-12.

A. I have it.

Q. Isn't that very trapezoidal tooth antenna there shown in Fig. 18-10-A with a central wire going down each of the upper and lower parts?

A. Yes.

Q. And you knew that worked before you made the sketch shown in Fig. 3 of Plaintiff's Exhibit 51.

A. Yes.

Q. You indicate below the Sketch 3, "Did not work for Alpha greater than 50 degrees." Isn't it a fact that you made the antenna of 18-10-A, Plaintiff's Exhibit 55, work for angles Alpha of greater than 50 degrees?

A. Yes.

Q. So you know how to make the wire tapezoidal tooth log-periodic antenna function as a log-periodic antenna before you made the Sketch 3 on Plaintiff's Exhibit No. 51.

A. Yes.

[509] Q. Wouldn't the same comments apply with regard to the zigzag configuration you show in Sketch 4 of Plaintiff's Exhibit 51?

A. Yes.

Q. And the same comments with regard to the symmetrical tooth structure shown in Sketch 2 of Plaintiff's Exhibit 51?

A. No.

Q. Tell us about what. Why not?

A. The sketch of Fig. 2 is a sketch of the first structure that I had in mind when I originally conceived the log-periodic antenna concept, and I tried it, and it did not work.

Q. Now, what date was that, Dr. DuHamel?

A. '56 or '55, along in there.

Q. Subsequent to that date did you learn how to make a symmetrical trapezoidal tooth structure that did work as a log-periodic frequency independent antenna?

A. I did not, no.

Q. Did anyone, to your knowledge?

A. Not that I know of of this configuration.

Q. May I call your attention, please, to Page 18-11 of your article in Plaintiff's Exhibit [510] 35.

A. Yes.

Q. In Fig. 18-9 there appears a legend, "Trapezoidal tooth log-periodic structure." Is that not a tooth log-periodic structure that does work as a log-periodic frequency independent antenna?

A. Yes, but it is not symmetrical along the centerline.

Q. May I hear that last answer, please.

A. But it is not symmetrical along the center—the structure of Fig. 2, Exhibit 51, has symmetry about the middle line of each boom. That of Fig. 18-9, the other exhibit, does not have symmetry about the middle lines.

Q. Does it have any symmetry at all?

A. Definitions of "symmetry" can become quite general. I think in the usual definitions of "symmetry" each individual element of the two—each one of the two elements do not have symmetry.

Q. When did the art learn how to make trapezoidal tooth log-periodic structures such [511] as shown in 18-9-A work as log-periodic frequency independent antennas, if you know?

Mr. Marshall: I object, your Honor, to the scope of the question. I don't believe that Dr. DuHamel can testify as to everybody in the art.

The Court: The last part of the question is, "if you know."

Mr. Marshall: If he knows.

The Court: If the witness doesn't know, he may say so.

By the Witness:

A. The structure shown there is very similar to the first curved tooth structure that Isbell and I reported. I first knew that this structure worked after I joined Collins Radio Company.

By Mr. Rines:

Q. And that would have been what date?

A. 1957.

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[514] Q. Dr. DuHamel, would you say that the only difference between the wire trapezodial tooth antenna shown in sketch 3 of Plaintiff's Exhibit 51 and the wire trapezoidal tooth antenna shown in Fig. 18-10-A, page 18-12 of the Jasik article, Plaintiff's Exhibit 55 is the center line conducting members that run down the upper and lower parts of the array?

A. Are you referring to only the mechanical differences?

Q. Let's take those first.

A. Rather than electrical performance?

[515] Q. Let's take those first.

A. Yes, I believe that's the only difference.

Q. Are there any electrical differences?

A. It depends upon the design parameters that you use. The structure of Fig. 3 of Exhibit 51 we originally investigated at Collins Radio and found it did not work, but we only tried Alpha angles greater than 50 degrees. Subsequently, others at other companies, and I think mostly the University of Illinois, tried these same structures with smaller angles and found that they worked satisfactorily, just something that we missed.

Q. May I ask you, please, to turn to your patent, De-

fendant's Exhibit 14, that is the DuHamel et al. patent 3,079,602.

A. Yes.

Q. Column 7, line 52. Would you read that paragraph into the record, please?

"It has been found."

Mr. Marshall: Did you want him to read it into the record, Mr. Rines, is that it?

[516] By Mr. Rines:

Q. Yes, please, Dr. DuHamel, would you read that paragraph, line 52 to line 59.

A. "It has been found that the center line conducting members 46 and 29 in Figs. 4 and 5 and 46 and 47 in Fig. 6 can be removed with some deterioration of broad bandedness but with substantial broad bandedness remaining. Then balance transmission lines are preferable, although a coaxial cable connected along the periphery of the teeth of one side to the apex could also be used to feed the antenna."

Q. Now would you refer, please, to Fig. 4 that was mentioned in that quotation. If we do as was stated in that quotation, remove the center line conducting elements 46 and 29, is not the mechanical configuration of the antenna of Fig. 4 then the same as that of sketch 3 of Plaintiff's Exhibit 51?

A. Yes, it is.

Q. Had you forgotten that you had made this statement back on March 14, 1958, when you testified earlier that you were not able to make a log-periodic antenna work with the configuration of [517] sketch 3 of Plaintiff's Exhibit 51?

A. I had not remembered this paragraph in there, but I think that it is a matter of degree of how much deterioration in broad bandedness and pattern characteristics is referred to here. It is rather vague terms.

[518] Q. So that nobody is confused, I believe you testified on direct examination and it appears at the top of Plaintiff's Exhibit 51 that the antennas of Plaintiff's Exhibit 51 did not work. Would it be more correct to say that they were not as broad banded as other log-periodic antennas but they did work?

A. I think you can say that most any wire that you put in space will work as an antenna. It will radiate or receive energy from different directions or have some mismatch and impedance. Exhibit 51 was qualified to the extent that Alpha was greater than 50 degrees. No qualification was made within the writeup here so that the statements in the patent could certainly apply for smaller Alpha angles; maybe not so for larger Alpha angles. I also might add that I think that the patent attorneys at Collins Radio were quite proficient and maybe took some liberties in describing all you could do to these that they had not really investigated experimentally.

Q. Would they have put in anything that you didn't think theoretically correct?

Mr. Marshall: I object to that question, [519] your Honor, as to what they did.

The Court: His answer to that has already been made, but the form of your question as it is now put is bad. Therefore I sustain the objection. He said, in effect, patent attorneys—he indicated them—all stretch it a bit.

By Mr. Rines:

Q. Did you take oath to this specification?

Mr. Marshall: Your Honor, I object to that question as to whether or not Dr. DuHamel took oath to the specification.

The Court: He said that was a document with his signature on it. We know as a practical matter he did, but the question during the trial of a lawsuit is improper. If it is material, you may bring in the document if it isn't already

in evidence showing that the witness did make oath to certain statements.

I sustain the objection to the question.

By Mr. Rines:

Q. It is incorrect that when the centerline conductors 46 and 29 are removed, that there is "some deterioration of broad bandedness but with substantial broad bandedness remaining"?

[520] Mr. Marshall: I object to that question. Again it goes to an interpretation of the document. This morning we were discussing the same sort of approach. This document speaks for itself. Now Dr. DuHamel has—

The Court: This is a little different, Mr. Marshall. What counsel is seeking to show here is that there is an inaccurate statement made in some claims in connection with the patent filed by this witness, and I am going to overrule the objection.

Mr. Marshall: Your Honor, I am not going to argue the point; I merely want to point out that I don't know whether Mr. Rines is concerned with the claims of the DuHamel patent or not or the disclosure of the DuHamel patent. He is now talking about the disclosure that is in the specification which may or may not indirectly relate to the claims.

The Court: Since you say you are not arguing, you have made your statement for whatever it is worth.

I will let him answer the question over the objection.

[521] The Witness: I think the answer depends—your question was—

The Court: Read the question to the witness.

The Witness: How much deterioration—

(Question read by the reporter.)

By the Witness:

A. That is a confusing question to me.

The Court: You may not characterize the question. If you are unable to answer it, I will excuse you from answering it. If you say you don't understand the question, then counsel can attempt to make it more clear. But you may not characterize the question.

The Witness: I do not really understand the question the way you had two different phrases in there referring to deterioration and some—

The Court: Make it more clear.

Mr. Rines: I will try to, your Honor.

By Mr. Rines:

Q. Is it a correct statement that when the centerline conducting members 46 and 29 are removed, that there is some deterioration of broad bandedness but that substantial broadbandedness remains?

A. It all depends upon how you define [522] broadbandedness. If I was describing this to the scientific community, I would say that probably it was not near as broad banded as you would like. The broad bandedness is determined in terms of frequency variation patterns and input impedance.

If I was trying to sell the antenna to a customer, I might say there is very little degradation.

So which frame do you want the answer in?

Q. What I want from you, Mr. DuHamel, is an answer as to whether it is a correct statement that when the centerline conducting members 46 and 29 are removed, that the antenna will not work or that the antenna works but with not so much broad bandedness?

A. The answer depends—I cannot give you one answer for that because it depends on the design parameters. If Alpha is small, very little degradation would occur; if

Alpha is large, greater than 60 or 70 degrees, considerable —a great amount of degradation occurs.

Q. So is the answer that for some angles of Alpha, the antenna will work without the centerline conductors but with not so much broadbandedness?

[523] Mr. Marshall: I object to Mr. Rines characterizing the answer. Dr. DuHamel answered the question.

The Court: Oh, it is not a characterization. The witness gave a qualified answer. I think counsel has a right to pursue it in an effort, if possible, to elicit an answer.

Here in these specifications the word "broad bandedness" is used in the paragraph which the witness read without any qualification.

Mr. Marshall: That is right.

The Court: It is the witness' patent, whether or not he swore to it, and I think counsel has a right to pursue that.

I overrule your objection, treating what you said as an objection.

Mr. Marshall: Would you read the question back?

(Question read.)

Mr. Marshall: I would like to further object to the use of the word "some." The witness testified as to the specific angles which were used.

The Court: I will let the witness answer over objection.

(Question read.)

[524] Mr. Rines: Why are you having difficulty?

The Witness: I think the specification—well, it gets to a matter of how do you define "broad bandedness," what is and what is not, and to,—

[525] Q. I am using the word, Dr. DuHamel, in the same sense that it is used in your patent.

A. Well, since these were results from ten years ago which I have not looked at since that time, I guess I can-

not give you a good answer at this time without reviewing those results.

The Court: When you say "These were results," you mean the results contained in Plaintiff's Exhibit No. 51 or the results as pictured in your patent?

The Witness: By "the results," I mean the measurements, the measurement data, that we obtained for these different structures, the radiation patterns and input impedance. Neither of these documents include any of that data.

By Mr. Rines:

Q. At the time that you filed the patent application, did you read the specification, including the phrase that was just quoted?

A. Yes. If you refer to the technical description as a specification—is that what you mean?

Q. Yes.

A. —in the patent disclosure? I normally [526] think of a specification as certain specifications of electrical characteristics or mechanical characteristics of antenna, which this is not.

Q. The description of the patent, columns 1, 2, 3 through 12. Can you answer the question? Did you read it at the time that the application was filed?

A. I think I did. I do not know how thoroughly I read it. With a lot of them coming through, sometimes you will skip over parts of them when you are in a hurry.

Q. Do you have any recollection of skipping over parts of this particular application?

A. No.

Q. Do you know whether you discussed it with the co-inventor, Mr. Ore?

A. No.

Q. Did you perhaps read it together with him?

A. I am sure we didn't read it together. I think we probably each read it separately.

Q. Do you recall Mr. Ore calling to your attention any inaccuracies in the application?

A. No.

Q. Would you please refer to Fig. 5 of your patent, Defendant's Exhibit No. 14?

A. Yes.

[527] Q. I would now ask you, please, to read into the record the sentence on column 6 of your patent, Defendant's Exhibit 14, commencing with line 11 in Fig. 5.

A. Okay. "Line 11 in Fig. 5, the apex part of portion 10 is defined by rods 56, 57, and 51 L. Likewise, in portion 11 the apex triangle is defined by rods 58, 59, and 53L."

Q. And the next paragraph?

A. "Fig. 2 may also represent a side view of any Figs. 3, 4 and 5 wherein their two half portions are separated by an angle psi which may vary from zero to 180 degrees."

Q. Is it correct that the triangle that you have read about is the shape of the antenna elements as distinguished from the trapezoidal or rectangular shape shown in Fig. 4, for example?

A. I don't understand your question.

Q. What is the triangle referred to in that quotation?

A. The what? The psi angle.

Q. No, the triangle, t-r-i-a-n-g-l-e.

A. The triangle there was formed by a simplification of truncating each element—or each of [528] the two half structures and was simply a method of getting in practice a better impedance characteristic—at least we thought it did.

Q. Is not the element of the triangle sometimes called a tooth?

A. I would not think of the triangle defined by 56, 57,

and 51 L as a tooth. I would think of the later teeth as being triangles.

Q. Excuse me.

A. I would think of the other teeth, like 51 B and 51 C forming a tooth—or a triangular tooth.

Q. Those are triangular teeth.

Is the thinckness of those teeth smaller as a result of the triangular construction than the thickness of the teeth in Fig 4?

A. Are you referring to an average thickness?

Q. Yes, sir.

A. Yes.

Q. And at the ends of the triangular teeth is not the thickness reduced almost to zero?

A. It's quite small, yes.

Q. Now I would ask you, please, keeping that figure, to refer now to page 18-3 of your article [529] in the Jasik handbook, Plaintiff's Exhibit 55.

A. Page 18—

Q. Dash 13.

The Court: That is 13 or 3?

Mr. Rines: My error. 18-13, your Honor.

By the Witness:

A. Yes, I have it.

By Mr. Rines:

Q. Below the figure, Figure 18-11, appears the sentence—first of all, it is correct, is it not, that Figure 18-11 shows the same Isbell log-periodic antenna that is shown in Fig. 1 of Plaintiff's Exhibit 1 that you testified about?

A. Yes.

Q. Below the figure it says, "It may be noticed that this antenna may be derived from that of Fig. 18-9 by letting the tooth width and the angle beta approach zero and then following the two half structures about the horizontal axis so that the angle psi approaches zero."

Would you now look at that Fig. 18-9 referred to in that quotation as it appears on page 18-11?

A. Yes.

Q. The angle beta shown in Fig. 18-9 represents the angle that the center conductor makes in [530] tapering, does it not, from one end of the antenna out to the free end?

A. Yes.

Q. And the statement in the quotation we just made from page 18-13 says that the angle beta should approach zero. Do you find anything corresponding to that zero beta in Fig. 5 of your patent, Defendant's Exhibit No. 14?

A. There is no beta defined. What do you mean?

Q. The angle beta has, in fact, been reduced to zero in Fig. 5, has it not?

A. Yes, roughly speaking, and this other statement was written roughly because it is a complicating limiting process, but I agree in essence with what you say.

Q. You agree.

A. Yes.

Q. Now, the angle psi is the angle included between the upper and lower portions shown in Fig. 5?

A. Yes.

Q. As a courtroom aid or chalk, we have a model marked for identification as Defendant's Exhibit [531] No. 24, which I would like to ask you if you agree that it corresponds to the mechanical layout of Fig. 5 of Defendant's Exhibit 14?

A. Yes, it does—approximately. Essentially so, yes.

Q. Now, so his Honor will understand this statement, folding the two structures about the horizontal axis so that the angle psi approaches zero, is it correct that what is done is to move these two halves so that they are parallel and the angle psi included between them is zero?

A. That is a good—yes, that is the essence of it.

Q. When that is done with the embodiment of Fig. 5, is it not true that the lengths of the antenna elements extending on both sides tapers down in a manner such that their ratio has the same figure Tau you testified to earlier?

A. Yes.

Q. And the electrical spacing along the antenna between the successive elements, the ratio of that has the same Tau you testified to before.

[532] A. Yes.

Q. Is it also true that because there are two separate conductors, that alternate antenna elements are crossed in connection 180 degrees in feed?

A. 180 degrees in phi? What do you mean by "phi"?

[533] Q. If you will refer, for example, to Fig. 1 of the Isbell Patent, Plaintiff's Exhibit 1, you see the cross feeds shown in Fig. 1?

A. I thought you were referring to an angle phi rather than—

Q. Feed, f-e-e-d, sir.

A. Okay.

Q. It is true, is it not?

A. Yes.

Q. Holding the antenna of Fig. 5 with the angle psi reduced to zero, do not the triangular elements protruding on opposite sides act like dipole elements?

Mr. Marshall: Your Honor, I object to that question, "acting like dipole elements."

Mr. Rines: Are they not dipole elements?

The Witness: They are not dipole elements as I define—as I am used to or as I would define them.

By Mr. Rines:

Q. Do they function in the same way to do the same result as dipole elements as you would define them?

A. Not quite. They are more broad band [534] than dipole elements because of their considerable extra thick-

ness or average thickness along the length, and it is two conductors rather than one forming each half of the dipole.

Q. Except for the matter of broad bandedness, do they receive energy, radio energy, in the same way as linear dipole elements?

A. That is not clear because of the relatively large displacement of the two bases or the two parts of each of the triangle. It is on the order of a tenth of a wavelength. Usually when you make a dipole its width is much smaller than a tenth of a wavelength.

Q. Don't you know, Dr. DuHamel, about conical or triangular dipole elements?

A. Yes, but those are usually inverted the other way such that the apices of each triangle or cone are together rather than at opposite ends.

Q. But they are broad banded, are they not, as distinguished from single wires?

A. Mostly because of their angular configuration which is considerably different than this, they [Copy Missing] [535] Q. Doctor, I didn't talk about monopolese.

A. No, I meant than this type of a triangle. I said the wrong word.

Q. So that there are dipole elements in the form of triangular shape elements, are there?

A. There has been in the past—maybe this configuration, too. I wouldn't—it depends on how you draw it. Now here everything is connected to the boom. Now what form are you suggesting?

Q. The dipole I am referring to is one element extending to the left, say, of the upper boom and the other element extending to the right of the lower boom; do they not act as a broad band dipole?

A. Yes. If you remove them from the structure and feed them symmetrically in the center, they certainly would act as a broad band dipole.

Q. Do they not act as a dipole the way they are fed in Fig. 15?

A. In Figure where?

Q. We are talking about the structure of Fig. 5, excuse me. I am wrong.

Fig. 5 of your patent, Defendant's Exhibit 14, with the angle psi reduced to zero.

[536] A. If I took those two elements you described and took them from the structure and fed them from one side rather than in the middle, it is not necesary that it would act as a dipole. It may have a directional—it would, rather than being omnidirectional, it might be directional, so that there is some difference depending on where you excite them at.

Q. Suppose I excite these two triangular elements one to the left and one to the right in the same way that two linear elements are excited. Do they not both act in substantially the same way as dipole elements in the reception of radio energy?

A. These would be broader band than dipole elements.

Q. By broader band you mean they would receive energy over a wider range of frequencies than the single elements? Is that a fair statement?

A. Say that again, please.

Mr. Rines: Would you read it?

(Record read.)

The Witness: The triangular dipole you have described there and separated from it would have [537] a larger band width than simple dipoles, especially with respect to impedance.

Q. Now would it be fair to say—would it be a fair characterization that the successive triangular dipole elements in the upper portion of Fig. 5. collapsed to psi equal zero—

Mr. Marshall: Your Honor—I will wait until you finish.

By Mr. Rines:

Q. —are in one plane and the dipole elements that extend in the opposite directions from the lower conductor are in a plane spaced therefrom, a second plane?

Mr. Marshall: I object to the question in that Mr. Rines is characterizing these elements as dipoles and the witness has not testified to the fact that these are dipoles.

Mr. Rines: May I have the answer to the preceding question, please?

(Record read.)

Mr. Rines: The witness has called these triangular dipoles.

Mr. Marshall: Your Honor, he has said when separated from the array as separate and [538] distinct units—not what Mr. Rines is attempting to characterize here.

The Court: Since there is a dispute as to what the witness meant, I think we should be fair to the witness and let him say what he meant when he used the words he used.

By Mr. Rines:

Q. What did you mean when you said "triangular dipoles"?

A. I tried to differentiate from a simple dipole antenna where you have two rods.

Q. Now the question I am asking you is taking those same triangular dipoles that you have been talking about, is it not correct that one half of those dipole elements in Fig. 5 closed up to an angle of psi equal zero lie in one plane and the other half lie in a plane spaced vertically from that first plane?

A. No.

Mr. Marshall: I object to that line of questioning as assuming something that isn't in evidence. This is not the testimony of the witness. He is characterizing the testi-

mony of the witness entirely differently than the way the witness has testified.

[539] The Court: Do you believe that counsel, the lawyer who is examining you, sir, has described your language inaccurately, and if you do, will you tell me in what respect he has?

The Witness: Well, he referred to triangular dipoles in one plane and triangular dipoles in the other plane. However, as I interpret him, there are no triangular dipoles in one plane there. If you want to use his analogy and approach to make a triangular dipole in a plane, it takes two of these triangular monopoles to be coplanar which they are not.

By Mr. Rines:

Q. Doctor, I think my question said "triangular dipole elements."

Is it not true that in the upper plane we have successive triangular elements of a triangular dipole, the opposite dipole elements of which appear in a spaced plane below?

A. Yes. If you are talking about one half of that being a part or a half of a triangular dipole.

Mr. Rines: Would you excuse me one moment, your Honor.

[540] By Mr. Rines:

Q. Is it a correct statement, Dr. DuHamel, that the current distribution over the two triangular elements of a triangular dipole of the same length as just two straight line dipoles is substantially the same as the current distribution on two straight line dipoles?

A. No. I think it depends upon the way that you excite —how you excite these two different—or how you excite the triangular dipole, and then upon the angle and the width of the base and so forth.

Q. Now let's assume that we are going to excite the two

straight line dipoles in exactly the same way that we are going to excite two triangular dipoles of the same electrical length; is it not a fact that the current distributions on these two dipoles are substantially the same?

A. Well, you have to define first to me what you mean by equivalent current distributions. In one case you have current along one wire and in the other case you have the current along two wires. Are you talking about the sum of those two currents?

[541] Q. I am talking about the resultant currents that come from each dipole.

A. The total resultant currents?

Q. Yes.

A. Well, they are different because their spatial distribution is different.

Q. Is the pattern of the current the same in the case of both types of dipoles?

A. No.

Q. That is, minimum at one end and maximum in the center in the case of a half wave dipole.

A. In the E plane or principal plane containing a dipole it will probably be very similar. In the other plane they will not be.

Q. Will you describe to his Honor the difference in the H plane.

A. It depends upon the width of the dipole base, and it may not be omnidirectional—it depends on the width of the triangular dipole base.

Q. If the spacing between two sets of dipoles is the same in the case of linear dipoles and triangular dipoles, so that I have an array of two sets of dipoles, two linear dipoles and two triangular dipoles, the same electrical spacing, [542] will not the current distribution in the H plane also be substantially the same in both cases?

A. What do you mean by "equal spacings"? At the base or at the tip or at the mid points?

Q. I mean the spacings of the electrical centers of the two sets of dipoles, equivalent electrical centers. Do you understand what I am asking?

A. Not quite, no.

Q. I show you, in Defendant's Exhibit No. 1, a simple dipole with a current distribution shown in the dashed line there above. Do you agree with that as a correct representation?

A. For a half wave dipole, yes.

Q. I show you a triangular dipole of the same electrical dimensions in Sketch 6 Defendant's Exhibit No. 2. Is not the current distribution, as represented by the dashed line, substantially the same—if you know.

A. That I am not sure of. It depends on how much difference—you know, what kind of differences you are talking about.

Q. Is it the same general shape of pattern? Do you know?

[543] A. I don't really know the current distribution on the triangular wire there, so I can't tell you how close it is.

Mr. Rines: No further questions.

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Redirect Examination by Mr. Marshall.

Q. Dr. DuHamel, in referring to Plaintiff's Exhibit No. 51, you mentioned the fact that in your analysis of several of these antennas which were built by you and which employed log-periodic structures which did not work, you indicated that you analyzed mathematically only one of the elements, is that correct?

A. Analyzed only roughly or approximately only one of them.

Q. Yes, sir. Now, you say you analyzed roughly ap-

proximately only one of them. Now, what do you mean by this?

A. I mean a simple—the simplest type of approximations were made to get some theoretical or to get some physical feel of the operation of this U-loaded dipole.

[544] Q. Approximately how many hours would have been involved in that mathematical computation for a single dipole?

A. For the single U-loaded dipole, it would probably take two days—one to two days of work to analyze it and obtain the answers.

Q. Now, if you were to analyze, if you could, mathematically the projected or prospective results for an array of dipoles, consisting of, as you have shown in the sketch, at least five dipoles, would you have been able to do that, first of all? Would you have been able to mathematically analyze the multi-dipole array?

A. Not for a configuration of Fig. 1 at the time that I was working on it without developing a new computer program. It would be a very lengthy process.

Q. Approximately how long would it take with pencil and paper and simple desk calculators?

A. It would take electronic computers, and for me it might have taken quite a while, but with help from people it would probably be a several months' job.

Q. Which was the other one which you mentioned [545] with respect to the sketches that you analyzed only one of the elements that was involved? Was it Fig. 2 that you mentioned that you made a mathematical analysis of one of the electrical elements?

A. I didn't mean to say that because I have not made any mathematical analysis of any of the other elements used in the other configurations. I don't think I said that.

Q. If you did say that, you stand corrected from the standpoint—

Mr. Marshall: Do you recall his testimony in that regard, Mr. Rines?

Mr. Rines: No.

By the Witness:

A. I stand corrected if I did say it.

• • • • •

[549] Q. Now, I ask you to take this wire configuration which Mr. Rines and I have been using and ask you to compare this structure rigorously with the structure which is shown in Fig. 5.

A. It is different in the sense that the thickness of the wires with which it is made does not decrease proportionately to the distance from the vertex. It has slightly different design parameters—well, those are unimportant. I was going to say as to whether this had the same Alpha angle or Tau ratio as we have in here—I don't think that is significant.

Q. Now, I ask you, with respect to this configuration which I have in my hand, and again referring to the elements which have been referred to as teeth, would you please describe the manner in which, if they do, the teeth width vary on the various elements which are employed, pointing them out to his Honor, if you would.

A. Well, first of all, we have to define a tooth width.

[550] Q. Would you please define a tooth width.

A. In this case the tooth width will be the width at the base of this triangle, and as you progress towards the vertex, this width decreases proportional to this distance from the vertex. We could also pick the average width, half way up or the width half way up, too, but it is hard to define the width of a triangle.

Q. Then with respect to the log-periodic principle, in what manner in applying a log-periodic principle so far as structures are concerned, would the tooth width have any bearing?

A. In what time frame are you asking this question?

Q. I am referring now, Dr. DuHamel, to the time when you made your invention which is set forth in DX 14.

A. Well, at that time, with the experience that we had with sheet structures, trapezoidal and triangular wire—triangular tooth structures, we felt that the width of the tooth gave greater band width for each individual tooth or monopole, if you like, and thereby gave better broad band performance [551] for the whole log-periodic array of them.

Q. Did the tooth width vary?

A. In all the structures that we made, the tooth width as defined by the outline of the wires approximating it did vary along the length of the antenna.

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Q. Did you perform any work, Dr. DuHamel, in connection with the preparation of Defendant's Exhibit No. 14, laboratory work and investigations?

A. Did I perform any work?

Q. Yes.

A. I directed the work. I maybe assisted slightly in some of the measurements, but I [553] gave technical direction to the work.

Q. Now, during this work were any logarithmically periodic rod antennas investigated which used dipoles as you understand them? I am talking about linear dipoles, such as are taught by the Isbell patent.

Mr. Rines: I object to that characterization, your Honor.

The Witness: No.

Mr. Rines: At the end of that question.

The Court: Such as, you mean? I think that is a valid objection. I will sustain the objection to the question, but you may re-put it without any characterization.

By Mr. Marshall:

Q. Dr. DuHamel, in the work which was carried out by you in connection with the development of the logarithmically periodic antennas which are described in Defendant's Exhibit No. 14, were any log-periodic dipole arrays employed which used linear dipoles?

A. No, we did not realize—we tried many variations of the wire structures, of removing wires from the trapezoidal teeth and things, but we [554] never hit upon the configuration that Isbell disclosed later.

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[554] PAUL EUGENE MAYES, previously called as a witness herein by the plaintiff, resumed the stand and testified further as follows:

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Direct Examination by Mr. Mann.

[572] Q. Dr. Mayes, would you turn to Page 18-13 and I refer your attention to the last sentence in the first full paragraph, the sentence beginning, "It may be noticed that this antenna may be derived," and so forth. Do you have that paragraph?

A. Yes, I do.

Q. Dr. Mayes, to your knowledge were the modifications of Fig. 18-9 which are referred to in this excerpt from Jasik ever made prior to the filing of the Isbell Patent in suit?

Mr. Rines: Objection, your Honor. The witness produced yesterday, Dr. DuHamel, was the author of this textbook. He testified with regard to these exhibits and the work that he was familiar with, and this sentence of his chapter. It seems to me that this is not the best evidence of the facts given in this particular document when this witness was available yesterday to be questioned on it, being the author of it.

The Court: Oh, I believe that any witness may, borrowing the words that you patent lawyers like to use so often—anyone skilled in the art [573] may answer a question dealing with the area with which we are concerned in this suit and which is discussed in Plaintiff's Exhibit 55.

Mr. Rines: I will withdraw my objection.

The Court: The mere fact that one person writes an article doesn't mean that it may not be interpreted by someone else. I would wish that some of the things that I write would be accepted by everyone else.

Mr. Rines: I withdraw my objection, your Honor.

The Court: All right.

By Mr. Mann:

Q. Do you have an answer?

A. I would like to hear the question again, if I may.

(Question read.)

By the Witness:

A. Well, these modifications were made by Isbell but not—I mean, the result of these modifications was attained by Isbell. He did not necessarily go about it in this way.

By Mr. Mann:

Q. Were these modifications ever made to [574] your knowledge by anyone other than Dwight Isbell?

A. No.

Q. Dr. Mayes, in the absence of the disclosure contained in the Isbell Patent in suit, in your opinion would it have been predictable that if the modifications suggested in the section of Jasik to which you have referred were made that the resulting structure would have the performance characteristics of Isbell's antenna?

A. No.

• • • • •

[576] Q. Do you find, Dr. Mayes, any teaching in DuHamel patent DX 14, that the width of the teeth in any of the structures depicted in the patent be reduced to zero?

A. Not that the width of all of the teeth be reduced to zero.

Q. Would you refer, please, Dr. Mayes, to the Katzin patent which has been introduced as Defendant's Exhibit DX 3.

Mr. Mann: Does your Honor have a copy?

The Court: I am sure I have.

Defendant's Exhibit 3?

Mr. Mann: Three, yes, your Honor. The Katzin patent 2192—

The Court: I am sure we have it. We have it.

[577] By Mr. Mann:

Q. Dr. Mayes, what does this disclosure teach to you?

A. This disclosure teaches a method of modifying a particular type of antenna array for the purpose of producing a more uniform response over a wide frequency band.

Q. What type of antenna array is involved?

A. The type of antenna array involved is one which is referred to as fishbone array.

Q. Was this a known general type of antenna at the time the Katzin patent issued?

A. Yes.

Q. Would you describe, Dr. Mayes, the manner in which the dipole elements are connected to the feeder line in the arrays shown in the Katzin patent?

A. All of the elements shown in the Katzin patent are connected to the feeder line by means of a capacitor—as far as the figures are concerned. A reference in the specification is also made to connection through other types of impedance elements.

Q. Would you refer in the specification to the [578] section which describes the connection through a capacitor, and would you—I am sorry. Answer that question first.

A. The section which refers to the connection through a capacitor is on column 2, lines 5 to 9. Shall I read it?

Q. Would you read it, please?

A. "The energy collecting doublets 1 are preferably untuned and coupled externally to the feeder members through limiting impedances herein shown preferably in the form of smaller series condensers, 1'."

Q. Would you point out in an appropriate figure the specific components referred to by the numeral 1'.

A. In Fig. 1 of the patent the numeral 1' is shown with lines indicating the location of the series capacitors between the collecting elements and the transmission line.

Q. Dr. Mayes, what is a capacitor?

A. A capacitor is an electronic component which will not allow the flow of the direct current, which will allow the flow of an alternating current [579] in a given amount, depending upon the size of the capacitor; that is, for a given applied voltage, an amount of current will flow, which depends upon the size of the capacitor.

Q. Does the existence of a capacitor in a line have any effect on the transfer of energy through the line?

A. Yes, it does.

Q. What effect does it have?

A. Well, depending upon the size of the capacitor, more or less energy may be transferred.

Q. Does the Katzin patent refer in any portion of its disclosure to a means of connecting the doublets without the use of a capacitor?

A. In the portion just read, it mentions limiting impedances, which may be in other forms than capacitors.

Q. What is meant by "limiting impedances" in that context to you, Dr. Mayes?

A. This indicates that the amount of energy which would be transferred from the collecting elements to the feeder line would be controlled by the presence of the limiting impedances.

Q. Is there any disclosure in the Katzin [580] patent which states that a direct connection can be made?

A. Yes.

Q. Where is that disclosure?

A. On page 2, column 1, lines 48 through 59.

Q. Would you read that section of the patent, please?

A. "Although the doublets have been shown capacitively coupled to the transmission line TL. It should be understood that the 'fishbone' type of array is not limited to such manner of coupling since the doublets may, if desired, be alternately connected either resistively or directly to the TL in the same manner as described in United States Patent No. 1,841,402, supra, and the present invention is applicable to any of these or other types of fishbone antennas wherein any desired type of coupling is used between doublets and line."

Q. Dr. Mayes, are you familiar with the disclosure of the patent referred to in that sentence?

A. The patent referred to in this copy—this number of patent evidently is a misprint. [581] There is another patent and another patent number which is given elsewhere in this patent which evidently is the correct one that should have been referred to in this—

Q. Will you point out where that other number—

A. That other number is given on column 1, page 1, line 14, wherein the number is 1,821,402, rather than 1,841,402.

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[582] Q. Dr. Mayes, I offer you a patent, Peterson 1,821,402, and I ask you if that is the patent to which reference is made.

A. Yes.

Mr. Mann: Your Honor, I would like to [583] mark this patent as Plaintiff's Exhibit No. 57 for identification and offer it into evidence. I am sorry we do not have additional copies but I will have them prepared as soon as possible.

The Court: Show it to counsel.

Mr. Rines: No objection.

The Court: With no obejction, Plaintiff's Exhibit 57 for idenification may be admitted into evidence as Plaintiff's Exhibit 57.

(Said document heretofore marked Plaintiff's Exhibit No. 57 for identification was received in evidence.)

The Court: What is the name of the patent?

The Witness: H. O. Peterson, your Honor.

By Mr. Mann:

Q. Dr. Mayes, in the light of the teaching of the Peterson Patent 1,821,402, how do you interpret the teaching in the Katzin Patent, Defendant's Exhibit 3, which states that a connection may be made directly as in the manner disclosed in the said Peterson Patent?

A. The essential element of these patents is that the coupling between the collector elements in the transmission line must be small. The [584] terminology used in the patent is that the collector items are loosely coupled to the transmission line. Now this may be effected as it is in Katzin through the use of limiting impedances such as the series capacitors. It also may be effected by using a particular length for the collecting elements. When a particular length is used, then the coupling may be made directly to the transmission line rather than through a limiting impedance and the impedance of the collecting elements themselves will serve as a limitation on the amount of coupling which occurs.

Q. Is there any limitation on the free transfer of energy in a direct coupling made in the manner disclosed in the Peterson Patent, 1,821,402?

A. Yes.

Q. Dr. Mayes, would you describe the directivity of the patent disclosed in the Katzin Patent, Defense Exhibit No. 3?

Mr. Rines: I didn't understand that question. Did you say patent?

(Question read.)

[585] By Mr. Mann:

Q. Would you describe the directivity of the antennas disclosed in the Katzin Patent, Defendant's Exhibit 3?

A. Yes. These antennas are unidirectional in directivity. They are unidirectional because of the way in which the elements are associated with the transmission line and because of the termination of the transmission line with a matched impedance.

Q. Would you point out the portion of the patent which deals with the directivity of the antennas?

A. Page 1, Column 1, Line 50.

Q. Would you read that section, please?

A. "To make the antenna unilateral in directivity, the end of the line TL nearest the desired transmitting station and farthest removed from the radio receiver is closed by a suitable terminating resistance R whose impedance is equal to the surge impedance of the line as loaded by the energy collecting doublets 1."

[586] Q. That is sufficient.

Now what is the physical orientation of this antenna relative to a broadcasting station when the antenna is in use?

A. The end of the antenna opposite the section of transmission line.

Q. Is that the large end or the small end?

A. Well, some of the figures herein shown, there is no large or small end.

Q. Let's refer to Fig. 3-C.

A. In Fig. 3-C it would be the large end of the antenna which is pointed towards the broadcasting station.

Q. What effect does this particular orientation have on the performance characteristics of the antenna?

A. The object of an antenna such as Fig. 3-C is to increase the band width of operation. However, in this type of array which is pointed towards the station with the large elements being nearest the station, there would be a shadowing effect of those elements with respect to the small element which would be a limitation insofar as the ultimate frequency range is concerned.

[587] Q. You mentioned earlier, Dr. Mayes, that this patent deals with a known class of antennas, did you not?

A. Yes.

Q. What new information is added to the art by this patent?

A. This patent speaks only to a method of producing a more uniform response over a wide frequency band for antennas of the form of the fish bone array.

Q. How is this effect accomplished?

A. The effect is accomplished by changing the length of certain elements or groups of elements, the collecting elements in the array.

Q. Is this teaching of improving the frequency performance by changing the lengths of elements in the array applicable in general to other arrays?

A. No.

Q. Why not?

A. It would depend upon the particular array whether or not changing lengths of elements or groups of elements in the array would, in fact, display an improved frequency characteristic.

Q. Would it be predictable in any particular [588] array employing dipoles that a modification in the lengths of the dipoles would increase the broad band performance?

A. Not in general.

Q. Would you refer, Dr. Mayes, please to the Schwartz Patent, Defendant's Exhibit 19, Patent No. 2,817,085.

Do you have a copy?

A. Yes, I have a copy.

Q. What does this patent teach to you, Dr. Mayes?

[589] A. This patent teaches a method of controlling the current distribution in the dipole elements of an in-line array in a manner which will produce an equal amount of current in a proper phase relationship across a given frequency band.

Mr. Mann: I apologize to the Court, your Honor, for breaking up the train of thought, but I have just remembered a question that I should have asked in connection with the Katzin patent, and I would like to go back to that for one question.

By Mr. Mann:

Q. Referring, Dr. Mayes, to the Katzin patent, is the method of connection shown in that patent—the method of connection between the dipoles and the transmission line—the same method of connection which is used in the Isbell patent in suit?

A. No.

Q. Thank you.

A. Let us go back now to the Schwartz patent.

How is the objective of the Schwartz patent achieved, Dr. Mayes?

A. The objective is achieved by altering the dimensions of the separate dipoles in the array, altering the angle which these dipoles make with [590] the axis of the antenna, and changing the characteristic impedance and the lengths of section of transmission line which are used to

connect the various dipoles in the driven section of the array.

Q. Is the structure shown in this patent a log-periodic structure?

A. No.

Q. Why not?

A. The lengths of the elements as given in the tables associated with the patent on column 6 do not have a variation which corresponds to the log-periodic variation.

Q. Would you point out specifically wherein the deviation from what would be a log-periodic structure occurs in the structure of the Schwartz patent.

A. In Table 1 on column 6, which refers to the seven-element antenna, element number 2, being the first driven element in the array, is given as being 50 inches in length. The next element, number 3, is 52 inches; the next one is 50 inches. So in just these three elements we have an instance where the length first increases and then [591] decreases.

Q. If this were a log-periodic structure, how should those lengths have changed?

A. They should decrease.

Q. Starting with element number 2?

A. Yes.

Q. What is element number 1 in the—

A. Element number 1 is a reflector; that is, it is a parasitic element. It is not connected to the transmission line.

Q. Would you point out whether this variation from log-periodic structure occurs in Table 2 also?

A. Yes. In the same manner in Table 2, which refers to a five-element antenna, the first driven element is element 2. It is 50 inches in length. Element 3 is 52 inches in length. Element 4 is 48 inches in length.

Q. Is this a log-periodic structure?

A. No.

Q. Would you refer to Figure 8 of the patent, Dr. Mayes.

What are the elements marked 23, 24, 25, 26 and 27?

A. These are halves of a dipole which are of [592] a particular configuration. This is referred to as a hairpin dipole, the purpose of the hairpin construction being to increase the band width of each individual dipole and also to provide a type of mechanical support.

Q. How does the band width of a dipole element of this type compare with that of a linear dipole?

A. The band width of an individual dipole of this type would be greater than the band width of a linear dipole which would have smaller cross sectional area.

Q. Will you point out in Figure 8 the transmission line which feeds the driven elements?

A. The transmission line is labeled 38 in Figure 8.

Q. How is the connection between adjacent dipoles made?

A. The connection between adjacent dipoles is made by separate sections of transmission lines of different types; that is to say, they have different characteristics. They are different lengths, different characteristics impedances, and these sections are labeled 23C, 24C, 25C and so forth.

Q. Is there any electrical transposition [593] between points of connection to adjacent dipoles?

A. No.

Q. Dr. Mayes, in your opinion would the effect of transposing the feeder line between dipoles be predictable in the antenna shown in Figure 8?

A. Not definitely, no.

Q. Can you explain that answer, your qualification, in any more detail?

A. Well, the effect of transposing the feed lines in any

given array would be dependent upon the array itself, and not having knowledge of the effect of making such a transposition in this particular case, I would not predict what would happen.

Q. What is the angle which the dipole elements, such as 23 and 24, make with the transmission line?

A. Do you mean what specific value?

Q. Well, can you find in the patent a discussion or a disclosure of what this angle is, either specifically or generally?

A. Well, the angles, I believe, are given in terms of a forward tilt of the arms rather than in terms of the description that you gave, in Tables 1, 2, and 3 in column 6.

[594] Q. Would you point out the specific values which are given?

A. In Table 1 we have forward tilt of the arms in degrees of elements 1, 2, and 3 as 30. The forward tilt of arms in elements 4, 5, 6, and 7 is 40 degrees.

Q. Are the corresponding dipole halves, such as elements 23, 24, 25, 26, and 27, in Figure 8 parallel to each other?

A. Not according to the angles which are listed in these tables.

Q. Dr. Mayes, would you refer, please, to Carter patent 1,974,387, which is Defendant's Exhibit 15. What does this patent teach to you, Dr. Mayes?

A. This patent teaches how antennas can be made which are composed of two yong wires, inclined at an angle with respect to one another, and how the radiation properties, in terms of the directivity, are increased by using such long wire antennas as opposed to dipoles which may be half wave lengths, for example.

Q. What is the objective of this patent?

[595] A. It is to provide a simple and efficient antenna system which uses standing wave current distribution to

achieve appreciable directivity in terms of the directional characteristics of the antenna.

Q. What forms of active elements are used to accomplish this?

A. The elements are as I described, two wires which are located in a plane and which make an angle with respect to one another which is other than 180 degrees.

Q. Is there any teaching of combining two or more of such elements to form an array?

A. Yes.

Q. What forms of arrays are taught?

A. Arrays where elements are located in parallel planes, one element above the other, and arrays in which the elements are located in the same plane, one behind the other, and combinations of elements where arrays of either of the foregoing types could be combined with other arrays of the same type.

Q. Have you—I am sorry. Have you finished?

[596] A. Yes.

Q. Will you refer, please, to Figure 9. What type of structure is shown there?

A. Figure 9 shows an array where a number of these elements, all lying in the same plane, are arrayed in an in-line relationship, one behind the other.

Q. Is the structure shown in Figure 9 a log-periodic structure?

A. No.

Q. Why not?

A. The element lengths are all the same.

Q. How is the connection to the feeder made in this case, Dr. Mayes?

A. There is no disclosure in this patent of any connection to the feeder other than the drawing in Figure 9.

Q. Is there any electrical transportation between adjacent V dipoles?

A. There is none shown.

Q. Is there any teaching that there should be?

A. No.

The Court: Mr. Mann, shall we take a brief recess.

(Short recess.)

[597] The Court: Will you continue, please, with your examination of this witness.

Mr. Mann: Your Honor, before we continue with the examination, I have had copies of Plaintiff's Exhibit 57 prepared and I would like to hand them up to the Court, please.

The Court: All right. Thank you.

By Mr. Mann:

Q. Dr. Mayes, referring to Fig. 9 of Carter Patent, Defendant's Exhibit 51, what are the two parallel lines on the left side of the figure which extend on either side of the line marked XX?

A. There is no actual discussion in the patent that I could find of what these parallel lines represent. Presumably they represent a two-wire transmission line.

Q. Let us assume for the purpose of this discussion, Dr. Mayes, that that is a transmision line; can you predict the effect of the performance of the structure shown in Fig. 9 if that transmission line were transposed between connections to adjacent dipoles rather than being parallel as it is shown?

[598] A. There would be no way of predicting. In general it would depend very much upon the frequency of operation, the relative lengths of the transmission line, and the radiating elements of the structure. In this type of array where there are numerous elements, there would be mutual effects between the elements and interdependence between the transmission line and the dipoles as components of this array which are extremely complicated.

Q. What are these mutual effects that you refer to, Dr. Mayes?

A. In an array of this type where there are a number of elements involved, each of the elements acts simultaneously as a receiving and as a transmitting antenna—that is to say, there would be energy sent out by each element, a certain amount of energy would be received by each element, and this phenomena is described generally under the term of mutual effects.

Q. Is this mutual effect phenomena restricted to a structure such as that shown in Fig. 9?

A. No. This would be true in any array which had more than one element—in any array, because [599] of course an array would have more than one element.

Q. Dr. Mayes, refer, please, to Kolster, Patent 2,580,798.

I am sorry. I withdraw the question. I would like to go back to my previous line of questioning.

[600] What is the interdependent effect that you referred to in one of your answers just a few minutes ago, Dr. Mayes?

A. Well, the function of the array is going to depend upon not only the mutual effect between elements, but also upon the other components in the array, and the other components in this particular array are the transmission line sections which would be used to couple one antenna to another and all antennas together to the receiver.

Q. Is this effect of interdependence among the elements restricted to a structure such as that shown in Figure 9?

A. No. This would be present in any antenna array which has a number of elements which are all connected together with transmission line sections.

Q. Would you refer now to Kolster patent number 2,580,798, which is Defendant's Exhibit 18. What does this patent teach to you, Dr. Mayes?

A. This patent teaches a method of using a simple

element with a large cross section together with one or more shorter parasitic elements which are closely spaced with respect to the [601] element of a broad or large cross section for the purpose of achieving an omnidirectional radiation characteristic which is usable over a relatively wide frequency band and also an input imepedance characteristic which is satisfactory for wide band operation.

Q. Would you point out the dipole in any of the drawings of the patent?

A. In Figure 1, one half of the dipole is labeled 12, and the other half is labeled 14.

Q. You mentioned that this dipole has a large cross section, did you not?

A. Yes.

Q. What is the effect of a large cross section?

A. This reduces the frequency sensitivity of the electrical properties of the dipole, particularly the input impedance.

Q. Is this type of dipole more or less broad band in characteristics than a linear dipole?

A. Well, this is a type of linear dipole which has a large ratio of diameter to length, and as the ratio of diameter to length increases, the frequency sensitivity decreases.

[602] Q. Would you point out the parasitic elements that you describe this structure as having?

A. The parasitic elements are labeled 28 in Figures 1 and 2.

Q. What is the nature of the directivity of this antenna, Dr. Mayes?

A. This antenna is omnidirectional; there is a pictorial representation in Figure 16 of the pattern in a plane which contains the axis of the dipole. The pattern in the plane perpendicular to the axis of the dipole would be a circle.

Q. How would the antenna be oriented physically in

order to have the type of pattern shown in Figure 16? That is, along which line would you—

A. The dipole axis would correspond to the vertical line shown in Figure 16.

Q. And the pattern looking down at the line YZ would have what shape?

A. I don't quite understand what you mean by "looking down at the—"

Q. If you were looking in such a direction that the line YZ appeared as a point rather than as a line—that would be looking down at the top [603] of the figure in a plane perpendicular to the paper.

Dr. Mayes, I think my question is insignificant, and I will withdraw it. It is unnecessarily complex.

Would you please refer to Godley patent 2,083,260, which is Defendant's Exhibit 16. What does this patent teach to you, Dr. Mayes?

A. This patent teaches a method of changing the current distribution on a vertical monopole type of antenna in a way which is proposed her to increase the radiation along the direction of the ground or at low angles above the ground.

[604] Q. What is shown in Figures 19, 20 and 21?

A. These Figures show various ways in which a single wire extending more or less vertically and perpendicularly to the ground plane can be altered in its configuration for the purpose of enhancing the low angle radiation.

Q. What type of a directivity would the structures of Figures 19, 20 and 21 exhibit?

A. These Figures would produce a radiation field which is essentially omnidirectional in the plane of the ground plane.

Q. How are the antennas fed in this patent, Dr. Mayes?

A. These antennas are fed with a generator which is connected from the lower end of the wire configuration.

One side of the generator is connected to that lower end and the other side is connected to the ground plane.

Q. Is there anything in this type of structure which corresponds to a transposition of points of connection between the feeder lines and the radiating elements?

A. No.

[605] Q. I would like to go back for one question to the Kolster Patent, Defendant's Exhibit 18, Dr. Mayes. Is the structure shown in this patent a log-periodic structure?

A. No.

Q. Will you refer now to Peterson Patent 2,375,580, which is Defendant's Exhibit 17, Dr. Mayes. What does this patent teach to you?

The Court: There is a Peterson Patent, Plaintiff's Exhibit 57. That is a different one, is it? H. O. Peterson.

Mr. Mann: That is a different patent. Mr. Peterson I think is a prolific patentee. This is a different patent, your Honor, 2,375,580 which is Defendant's Exhibit 17.

By the Witness:

A. That patent teaches a method of obtaining a unidirectional radiation pattern from a two-element array.

By Mr. Mann:

Q. Would you point out the two elements of the array?

A. In Figures 1 and 4 the two elements are labeled 7 and 8; in Fig. 5 they are labeled [606] 25 and 26; in Fig. 6 they are labeled—one element is labeled 31-32; the other element is labeled 33-34; in Fig. 37, one element is labeled 37 and the other element is labeled 38; in Fig. 8 one element is labeled 47 and the other element is labeled 48.

Q. What does the patent teach concerning whether these dipoles must be identical or not?

A. The patent relies upon the antennas receiving equal signals in order to produce the unidirectional pattern.

For this purpose the antennas should be very nearly the same.

Q. Could a structure of this type be considered as a log-periodic structure?

A. No.

Q. Why not?

A. It only has two elements and they are of equal size.

• • • • •

[625] By Mr. Rines:

Q. Dr. Mayes, if the two booms of the Blonder-Tongue Dart antenna, Plaintiff's Exhibit 10, are moved together so that they are substantially in the same plane, very close, very small separation as compared with the three-quarters of an inch, will there not be a serious mismatch between this antenna and the 300 ohm transmission line feeding it over the UHF band?

A. I am sorry. Could I have the reporter read [626] the question?

The Court: Please read the question to the witness.

(The question was read by the reporter.)

The Witness: Yes.

By Mr. Rines:

Q. Will this not result in a serious deterioration of the gain or figure of merit of the antenna?

A. Yes.

Q. And the same remarks would apply for its frequency band to the Color Ranger antenna, Plaintiff's Exhibit 35?

A. Not to the same degree with respect to all frequencies in the VHF band.

Q. But certainly to some of the frequencies.

A. To some of the frequencies, yes.

• • • • •

[627] By Mr. Rines:

Q. Referring to Plaintiff's Exhibit 36, which you also stated did not work as a log-periodic broad band structure, would you tell his Honor when you constructed the dipole array of Plaintiff's Exhibit 36?

A. I don't recall specifically the time period in which this work was done, but it was some few months, probably within a year, after the work of Isbell.

[628] Q. And certainly by the time of the work of Isbell, the concept of transposed feeders or crossed feeders was already known, wasn't it?

A. Yes.

• • • • •

Q. You also testified, Dr. Mayes, that there were literally hundreds of attempts to make various kinds of structures work as log-periodic antennas, do you recall that?

A. I believe my testimony was that there were approximately a hundred.

Q. Excuse me. I stand corrected.

Were there a hundred attempts to achieve operation with a structure of the Isbell patent, Plaintiff's Exhibit 1?

A. With that specific structure, you mean?

Q. Yes.

A. Well, I would say there were quite a number of models built. Most of them operated satisfactorily. I wouldn't say that there were a hundred models of that antenna constructed, but there [629] were a hundred models of log-periodic antennas which were constructed in an attempt to get frequency independent performance.

• • • • •

[630] Q. Dr. Mayes, would you tell the Court what financial arrangement you have with the University of Illinois Foundation with regard to receiving royalties for the license sale of log-periodic antennas embodying the inven-

tions of the Isbell and [631] Mayes and Carrel patents here in suit?

A. There is no formal arrangement as far as I know.

Q. Do you receive royalties?

A. I have.

Q. Would you tell his Honor what those royalties are based upon?

A. They are based upon the fact that my name appears on several patents which are in the package of patents which are licensed and for which royalties have been received by the Foundation.

Q. And the Foundation pays some of those royalties over to you?

A. Yes.

Q. You have also testified, Dr. Mayes, that you have been a consultant for the counterclaim defendant, JFD, is that correct?

A. Yes.

Q. Is it not true that you, in this connection, also, received from JFD additional sums on the sales of JFD antennas that—

Mr. Mann: Your Honor, I object.

The Court: Let him finish his question. I [632] think it is objectionable, but he has a right to finish his question. Finish it, please.

By Mr. Rines:

Q. —that employ the inventions of the patent here in suit.

Mr. Mann: I object at this time, your Honor.

The Court: I sustain the objection.

[633] By Mr. Rines:

Q. What is the nature of your remuneration as a consultant for JFD?

Mr. Mann: Objection.

The Court: I sustain the objection. That question would make your last question proper. That question is objected to and the objection was sustained.

By Mr. Rines:

Q. Do you have financial arrangements with JFD in connection with your consultant activities?

Mr. Mann: I object to that, your Honor. I don't see the materiality.

The Court: I sustain the objection.

• • • • •

[636] By Mr. Rines:

Q. "Q. Where do you do supervision of research at the University?"

The Court: Is that intended to support your asking whether he is Associate Director?

Mr. Rines: No. This was the first question, your Honor, to which the answer was "In the Antenna Laboratory of the University."

The second question:

"Are you the head of that laboratory?

"A. No, sir. I am Associate Director.

• • • • •

[637] By Mr. Rines:

Q. Dr. Mayes, is it not a fact that you are the Associate Director of the Antenna Laboratory of the University of Illinois?

A. I have been referred to as such. What I testified to a moment ago was that there is no formal agreement with respect to the University. The University does not recognize such an appointment.

• • • • •

[639] Q. The document referred to is the Schwartz Patent, Defendant's Exhibit 19.

A. I have a copy of it.

Q. Would you please refer to Column 11 and would you read into the record, please, the sentence beginning with "The" on Line 62 of Column 11.

A. "The present invention could be practiced with a greater or lesser degree of success with any of these other type of antenna elements by directing active elements constructed to have progressively increasing impedances as you approach the rear active element."

Q. Is not that language "to have progressively increasing impedance as you approach the rear active element" consistent with log-periodic operation?

[640] A. No.

Q. Do the antennas of Isbell, the Isbell Patent, Plaintiff's Exhibit 1, have progressively increasing impedance as you approach the rear active element?

A. No.

Q. What is true of the variation of empedances as you approach the rear active element in Isbell?

A. The Isbell antenna contains a number of dipoles with a wide variation in lengths so that since the impedance depends very much upon the length of the dipoles, and since there may be a wide variety of dipole lengths on the structure, the dipole impedance may vary in a manner of both increasing and decreasing as you go from one end of the antenna to the other.

Q. Would you refer to Plaintiff's Exhibit 1, please, the Isbell Patent, and tell his Honor which of those dipoles are of increasing impedance as you approach to rear active element and which are of decreasing impedance.

A. First of all I would have to say that this variation would depend upon the frequency of operation and could be strictly made with respect [641] to the impedances of each individual element when it is not in the array.

If we take a low frequency of operation, such that some of the elements near the rear end of the antenna are

approximately one-half wavelength in dimension in over-all length, these dipoles would be of a relatively low impedance. Then as we go toward the front end of the antenna toward the smaller dipoles, which are progressively shorter, the impedance of these dipoles would be larger.

Is this sufficient to answer the question?

• • • • •

[665] *Redirect Examination by Mr. Mann (Resumed).*

Q. Mr. Mayes, this morning you testified that the spacing in the unmodified form of defendant's antenna, the Golden Dart antenna, Plaintiff's Exhibit M, was about one-fifteenth of a wave length, is that correct?

A. Yes.

Q. Can you tell us more precisely what the actual spacing is?

In terms of wave length.

A. Yes. One-eighteenth of a wave length.

[666] Q. Does this separation of one-eighteenth of a wave length apply throughout the entire frequency range of operation?

A. No. That is at the end of the frequency band where the wave length is the smallest.

Q. When the antenna is operating at its low frequency limit, what would be the approximate spacing in terms of a wave length?

A. Approximately twice that. In other words, a ninth of a wave length—no, excuse me. The other way A 36th of a wave length.

Q. Thank you.

In connection with the modification of the Golden Dart antenna which you tested, can you tell me about how much free space existed between the edges of the transmission wire in the modified form of the antenna?

A. Approximately a quarter of an inch.

Q. How many diameters of the wire of which the antenna is formed does a quarter of an inch represent?

A. About two diameters.

Q. Is a separation of two diameters in a transmission line a serious departure for co-planar, [667] Dr. Mayes?

A. Well, as far as the transmission line is concerned, the wires would be co-planar. The transmission lines conductor lie in a plane.

Q. That is, a vertical plane.

A. A vertical plane, yes.

Q. Let me ask more specifically in connection with this antennna. Are the separate halves of a dipole which are separated by one-eighteenth of a wave length essentially co-planar?

A. As far as the dipole operation is concerned, yes.

* * * * *

[670] Q. Dr. Mayes, will you refer to Plaintiff's Exhibits 31 and 32. Do you have them before you?

A. Yes, I have them.

Q. Was the antenna shown in Plaintiff's Exhibit 31 operative?

A. No.

Q. Was the antenna shown in Plaintiff's Exhibit 32 operative?

A. No.

Q. In each case can you ascribe the inoperativeness to the presence of the ground plane in each antenna structure?

A. Not specifically. There would be another antenna which would be equivalent to this which would have no ground plane.

Q. Does the antenna shown in Plaintiff's Exhibit 31 not work because of the presence of a ground plane therein.

A. Well, a ground plane in this antenna is a necessary part of the structure since there is [671] only a single element shown here. In other words, we need two elements

in order to form the antenna to be exited from a two-wire transmission line or coaxial cable. I would not ascribe the inoperativeness of this antenna as being explicitly due to the ground plane but the ground plane is an essential element of this particular method of constructing the antenna.

Q. Do you know of any operative log-periodic antennas which do employ ground planes?

A. Yes.

Q. Could you refer, please, to Plaintiff's Exhibit 36? Was this antenna structure operative?

A. Not in a frequency independent manner, no.

Q. Was its failure to perform in a frequency independent manner due to the fact that the transmission line is not transposed between adjacent dipoles?

A. Yes, I would say primarily this is the reason that this antenna did not perform.

Q. Is it a general principle, Dr. Mayes, that every log-periodic antenna must have a transposed feeder?

A. No.

[672] Q. Was it predictable in this case that that was the reason why it did not work?

A. No.

* * * * *

[674] Q. Dr. Mayes, this morning you testified as follows:

"Q. In this antenna of the Godley patent—" and I might say that Godley patent is Defendant's Exhibit 16. I will repeat the question:

"In this antenna of the Godley patent is it not a fact that all of the structures of Figs. 19, 20, and 21 do substantially the same thing in substantially the same way?"

Your answer was: "Yes."

[675] Would you explain what "the same thing" is to which you referred in your answer?

A. In this case, these meandering wires are erected in a manner substantially perpendicular to the ground plane in order to produce an omnidirectional radiation pattern with on electric field which is also perpendicular to the ground plane. The shape of the wires is formed in such a way as to affect the current distribution in a manner which the patent says will increase the amount of radiation along the ground plane.

Q. Are you through?

A. Yes.

Q. Do you find in this patent any teaching that any one of these three configurations may be used interchangeably in any array of any type?

A. In other words, that these can be used as elements in arrays?

Q. If one element is useful in an array of any particular type, does it follow that one of the other configurations could be substituted in that aray and the results would be equivalent?

A. That would not necessarily be equivalent [676] in general. There is a statement that these elements can be applied as radiating elements in an array.

Q. Would you refer to Defendant's Exhibit 17, please, Dr. Mayes. You testified concerning the teaching of the patent on page 2, lines 61 through 67, beginning, "Furthermore, a combination of two antennas." Do you have the section, Dr. Mayes?

A. Yes.

Q. Does that portion of the patent tell you specifically how these several groups of antennas should be connected?

A. Yes. According to the principles heretofore described.

Q. If you made the connection taught by the patents, would the resulting combination be a log-periodic antenna?

A. No.

Q. Why not?

A. The principles of the patent are that the elements be receptive to the incoming wave in essentially the same way; that is to say, that the signals must cancel in order for the antenna to be operative, which means that each element must receive [677] approximately the same signal, and therefore all the elements would need to be approximately the same size.

Q. What about the spacing between the elements in the several groups of elements?

A. There is a permissible range of spacings. This statement says that "Another group of similar antennas displaced from the first group." I presume that "similar" would allow some change in the spacing.

Q. Would this variation in spacing amount to a log-periodic variation in spacing?

A. Not necessarily.

• • • • •

HAROLD D. LAWLER called as a witness by the plaintiff herein, having been first duly sworn, was examined and testified as follows:

[678] *Direct Examination by Mr. Marshall.*

Q. Mr. Lawler, will you please state your full name and address?

A. Yes. Harold B. Lawler, 490 East Florida, Urbana, Illinois.

Q. What is your present occupation?

A. Business manager, Department of Electrical Engineering, University of Illinois.

Q. How long have you held that position, Mr. Lawler?

A. Since 1956.

Q. Would you please describe your duties and responsibilities as business manager?

A. My basic duties are to see, as far as research is concerned, that all of the requirements of our various research contracts and grants are conformed to.

Q. Mr. Lawler, there has been introduced into evidence Defendant's Exhibit No. 22 which is a transcript of the testimony of a Miss Marjorie Johnson. Do you know Miss Johnson?

A. Yes.

Q. Who is Miss Johnson?

[679] A. Miss Johnson was our technical editor in the Department of Electrical Engineering, oh, roughly from 1956 to 1960, somewhere in that area.

Q. In your capacity as business manager did you have any authority over Miss Johnson's activities?

A. Yes.

Q. What was that authority?

A. I was her immediate supervisor at that time.

Q. Are you familiar with her duties and responsibilities?

A. Yes.

Q. Do you know what job she held while she worked for you?

A. Her official title was assistant to editor. Her function was technical editor of our research reports.

[680] Q. As technical editor, what did she do?

A. Her job was to see that the reports were typed, printed and distributed in accordance with the requirements of each contract or grant.

Q. Did the department in which Miss Johnson worked have any designation as such?

A. Well, it was called the Publications Office.

Q. What were the various reports which were edited by that department or that office?

A. The normal type of reports required by our contracts which would be a progress report which would be on some sort of a calendar basis and technical reports such

as were prepared when some specific phase of the work was completed. These would be the basic reports she was responsible for.

Q. Were these reports prepared in connection with any activities of the Electrical Engineering Department?

A. Yes. They were prepared as required by each of our—oh, at that time approximately 50 to 70 research contracts or grants.

Q. You say at that time. Do you know when [681] Miss Johnson worked for the Publications Office of the Electrical Engineering Department?

A. A few minutes ago I think I said from approximately 1956 to 1960, but it would be a little later than that because there was another lady in the job when I came there. Probably about 1958 to 1962 might have been a better estimate of time.

Q. You say at this time there were how many during this period of 1958 to 1962, approximately how many contracts were being administered by the Electrical Engineering Department?

A. Approximately 50.

Q. What, if anything, did Miss Johnson's office have to do with the issuance and circulation of technical reports?

A. You say technical reports?

Q. Would you answer that first, if you will.

A. All right. Technical reports as such, it was her job to get the—the author would bring the manuscript to her in whatever form he may bring it to her. It was her job to see that it was typed, printed and distributed in accordance with the distribution list.

[682] Q. What was her responsibility in the processing of quarterly reports?

A. Basically the same.

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[684] Q. Mr. Lawler, in Miss Johnson's testimony which is included in Defendant's Exhibit 22 at Page 202, the question was directed to her:

> "Do you recall whether in April of 1959, Miss Johnson, the Engineering Research Laboratory of the University had a local library?
>
> "A. Yes, it did."

I ask you, Mr. Lawler, did the Electrical Engineering Research Laboratory of the University of Illinois have a library?

A. No, not as such.

Q. Did it have a depository for the documents and reports which were issued out of the Publication Office.

A. Yes.

Q. What was that depository known as?

A. It was known as the local reading room, the Electrical Engineering Reading Room.

Q. During the period between January 1959 and January 1962, in what manner was this reading room operated?

[685] A. This room was not attended during this period of time. If anyone wanted reports which had been issued by the Electrical Engineering Department, they could obtain these reports by going to the Publications Office and having one of the members of that staff go to the locked files and sign it out to them.

Q. Was information concerning the various documents and reports which were filed in the reading room available to one?

A. Yes.

Q. In what manner was it made available?

A. A card file which was maintained in the Publications Office.

[686] Q. Now, in what manner was that card file prepared?

A. This file was prepared once a report had been completed, distribution made in accordance with the distribution list, the report would be cataloged and placed in the locked file.

Q. Mr. Lawler, did the Electrical Engineering Department have a policy with respect to making available technical reports to others than those who were listed on the circulation lists?

A. Yes.

Q. What was that policy?

A. You used the term "technical reports." Is this what you mean?

Q. The quarterly reports.

A. The quarterly reports. Quarterly reports normally were restricted in their distribution. Distribution had to be made, first of all, in accordance with the distribution list which the contractor would supply.

Q. Mr. Lawler, I would like to show you a copy of the front cover of the Defendant's Exhibit No. 8, which is the cover page of "Quarterly [687] Engineering Report No. 2," and ask you to take a look at that, please.

I refer you specifically, Mr. Lawler, to that portion of the cover page which bears the note, "This report is not to be announced or distributed automatically in accordance with AFR205-43A, Paragraph 6-D." Do you see that notice?

A. Yes, sir.

Q. Do you know what the significance of that notice is, Mr. Lawler?

A. Yes, sir; I do. This particular reference restricts the distribution of this report to foreign nationals. Roughly this was what this reference is for.

Q. Is there any particular period of time involved in the restriction?

A. I believe it is a period of two months after it has been announced domestically by what was then asked here.

Q. Mr. Lawler, does the University of Illinois maintain any libraries?

A. Yes, it maintains several libraries.

Q. Upon my request did you have the opportunity to check the contents of these particular [688] University of Illinois libraries?

A. Yes.

Q. Which ones did you check?

A. I checked—well, I checked the one to which I knew there had been some distribution of this particular report.

Q. When you say "this particular report," what report are you referring to?

A. This "Quarterly Report No. 2."

Q. Was that the essence or the gist of my request to you, to look for particular copies of that report?

A. Yes.

Q. What did you find?

A. I found that the Engineering Library did have two copies of this report on file.

Q. I show you what has been marked as Plaintiff's Exhibit No. 70 for identification and ask you to identify that exhibit, please.

A. This is one of the two copies which the Engineering Library had in their files at the time I went to them.

Q. I show you what has been marked as [689] Plaintiff's Exhibit No. 71 for identification and ask you if you would identify that exhibit, please.

A. Yes, sir. This is the other one. These are the two copies which I obtained from the Engineering Library.

Q. Were you able to find any other copies of Quarterly Report No. 2 in the University of Illinois libraries?

A. No.

Mr. Marshall: Your Honor, I would like to introduce

into evidence what has been marked for identification as Plaintiff's Exhibit No. 70 and what has been marked for identification as Plaintiff's Exhibit No. 71.

Mr. Rines: No objection.

The Court: With no objection, Plaintiff's Exhibits 70 and 71 respectively for identification may be admitted into evidence as Plaintiff's Exhibits 70 and 71.

(Said documents heretofore marked Plaintiff's Exhibits 70 and 71 for identification, were received in evidence.)

[690] By Mr. Marshall:

Q. Mr. Lawler, referring to Plaintiff's Exhibit No. 70 initially, would you please refer to the imprinting which is included on the cover page in the upper right-hand corner and read the date which is written there or printed there, imprinted there.

A. It says, "University of Illinois Library, December 4, 1959."

Q. Referring to Plaintiff's Exhibit No. 71, in the same location, would you please read the date that is imprinted there.

A. The best I can read—I can read "July 1959." I cannot read the particular date.

Mr. Marshall: I have no further questions, your Honor.

The Court: Is there any cross-examination?

Mr. Rines: Yes, your Honor.

Mr. Marshall: Your Honor, I would like to point out at this time—there are no further questions, but there has been a stipulation that the Quarterly Report No. 2 was mailed for circulation on May 5, 1959. This stipulation has already been of record.

[691] The Court: You mean in writing.

Mr. Marshall: Yes, your Honor.

* * * * *

Cross-Examination by Mr. Rines.

* * * * *

[691] Q. Mr. Lawler, in April and May of 1959 wasn't one of Miss Marjorie Johnson's duties the duty of librarian

of the Local Library of the Electrical Engineering Research Laboratory at the University of Illinois?

A. She was in charge of the Reading Room, yes.

[692] Q. Mr. Lawler, I said "Local Library," not "Reading Room."

A. Well, if you want to call it a Local Library, all right. It was not an official University library.

Q. But it was a local library and called that by the people in the Antenna Laboratory, was it not?

A. I don't know.

Q. Did they not?

A. I don't know what they might have called it. I always called it a reading room.

Q. You don't remember ever having called it a local library?

A. I can't say that I wouldn't have.

Q. Who, Mr. Lawler, had more detailed information with regard to the availability of and dates of publication of the Quarterly Reports, Defendant's Exhibits 7 and 8, you or Miss Marjorie Johnson?

A. She would probably have more detailed information on them, yes.

• • • • •

[693] *Redirect Examination by Mr. Marshall.*

Q. Mr. Lawler, did Miss Johnson have anything to do with setting the policy of the Electrical Engineering Research and Development Department Publications Office?

A. She was primarily responsible for the carrying out of the requirements of the contracts.

Q. My question was did she have anything to do with setting the policy of that office.

A. Policy was set primarily by the head of the department.

Q. And was she the head of the department?

A. No.

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[703] ISAAC S. BLONDER called as a witness by the Counter-claimant herein, having been first duly sworn, was examined and testified as follows:

* * * * *

Direct Examination by Mr. Rines.

[706] Q. Will you please state to his Honor your name, residence, and occupation?

A. Isaac S. Blonder, Clay Court, Locust, New Jersey, chairman of the board, Blonder-Tongue Laboratories and several other occupations. That is my principal one.

Q. Are you the same Isaac S. Blonder who is one of the co-patentees of Patent 3,259,904 in suit?

A. Yes.

* * * * *

[707] Q. Would you please state to his Honor your educational experience?

A. A Bachelor's degree in physics, the University of Connecticut in 1938, a Master's degree in physics—

The Court: What is a Bachelor's degree in physics?

The Witness: It is a Bachelor of Science degree—

The Court: A Bachelor of Science degree.

The Witness: Yes. I beg your pardon. A Bachelor of Science degree, a major in physics.

[708] The Court: I never heard of a Bachelor of Physics. That is the reason I asked.

The Witness: I was the only physicist. I felt rather self-conscious.

By Mr. Rines:

Q. Would you continue?

A. I had a Master of Science Degree from the University of Cornell in 1940. During about four years of service in the Signal Corps I attended several radar schools, one in England and one in the United States.

Q. Will you tell his Honor what professional activities you are engaged in since leaving the Signal Corps.

A. I was employed as an instructor at the City College of New York in the years of 1947 and 1948 as an instructor in Engineering Physics. I would say that my entire career is that of an instructional one since most of my career has been that of an employer and I feel that most of my entire time is spent in instructional activities.

Q. Following your instructorship at City College of New York, what professional activities [709] did you engage in?

A. I was employed as an engineer in a television manufacturing corporation, Tele-King Corporation of New York, 1948 to 1950. After that I formed my own company, Blonder-Tongue Laboratories.

Q. Would you tell his Honor what business Blonder-Tongue Laboratories is in?

A. Blonder-Tongue Laboratories is enaged in the manufacture of equipment for the distribution of television signals from the reception point to the television set. This includes antennas, amplifiers, tap-offs and, indeed, closed circuit television cameras and monitors.

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[711] Q. Are you a member of any learned societies?

A. I am a member of IEEE; Electronics Industry Association, and several committees thereof.

Q. What is IEEE?

A. Institute of Electric and Electronic Engineers.

Q. Do you serve on any technical committees?

A. Yes. I am a member of the General Standard Committee of the Electronics Industry Association. This committee supervises the standards submitted to EIA by other committees.

I am a member of the Closed Circuit TV Committee of EIA. I was a member of the [712] CAB Committee sponsored by the FCC for the introduction of UHF, ultra high frequency television in the United States.

I am a member of the Tuner Committee of EIA. I am a member of the Standard Committee of the National Community Television Association. I am a member of Panel 15 of the National Electrical Code Safety Committee based in Chicago. And there are several other committees that I keep in touch with.

• • • • •

[759] Q. As one skilled in the art, can you tell the Court whether the antenna of Defendant's Exhibit 27-A—

Mr. Cass: Your Honor—I am sorry. Complete your question, I am sorry.

By Mr. Rines:

Q. —has a structure that does or does not produce deleterious electrical field pattern aberrations of the type mentioned in column 1, line 24, of your patent, Defendant's Exhibit 26.

Mr. Cass: Your Honor, I object to the introduction of that question as characterizing this particular witness as one skilled in the art. I have not seen where he has been qualified to be—

The Court: You may reply to the objection.

Mr. Rines: I believe we have put in a large number of qualifications of Mr. Blonder in this art, including the fact that he is the patentee of Defendant's Exhibit No. 26 and that he has degrees in physics, including a Master's degree, [760] that he is the head of this company that has been manufacturing these antennas, and that he is a member of numerous committees dealing with master antennas in television in learned societies.

The Court: Why do you say he isn't, to use the patent jargon, skilled in the art? I have had witnesses, I might say, testify in patent cases who apparently knew a lot less about the patent in suit who were described as persons skilled in the art.

I am not carried away by that description. I will weigh a witness' testimony in the light of his experience and

what he testifies to. To me the words "one skilled in the art" are—I think they told us in law schools more years ago than I care to say publicly—descriptio personae. That is all.

Mr. Cass: My objection to it was, your Honor, that it hasn't been established what art he is particularly talking about, the scope of that art, and the degree of skill.

The Court: Well, as counsel says, what he has testified to makes him skilled in the art with which we are here dealing. You will have an [761] opportunity to cross-examine here, and perhaps you can demonstrate that he is not in fact skilled in the art.

I will let him answer over objection.

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[802] By Mr. Rines:

Q. Mr. Blonder, I show you a document entitled "Revolution In The Air, JFD Log Periodic," marked for identification as Defendant's Exhibit 35, and I ask you if you can identify the same.

A. Yes.

Q. What is it?

A. It is an advertisement by JFD Company.

Q. Do you know when you first saw that exhibit?

[803] A. I think it was in the middle of '63, late '63.

The Court: What is that number?

Mr. Rines: Defendant's Exhibit 35, your Honor, and I move the admission into evidence of Defendant's Exhibit 35.

[804] Mr. Marshall: Your Honor, I would like to object on behalf of the University of Illinois Foundation on the ground that I don't quite see the relevance and materiality of—

The Court: I don't know what it is.

Mr. Rines: Your Honor, here is an extra copy.

The Court: An objection is made by the plaintiff on the ground that there is no relevancy. Will you point it out, please, if you can.

Mr. Rines: Yes, your Honor.

This is a suit for infringement by JFD of log-periodic antenna patent of Blonder and Schenfeld and for unfair competition and antitrust violation in connection with the sale of log-periodic antennas by JFD. The witness has identified this as a bulletin of JFD, and on its face, your Honor, it shows that it is describing the antennas of JFD, which are the very subject matter of the counterclaim on unfair competition and anti-trust violation.

The Court: Are you finished?

Mr. Rines: Yes, your Honor.

The Court: You may reply.

[805] Mr. Marshall: From the standpoint of relevancy, your Honor, I don't quite understand where the issuance of an advertisement which has been put out by—assuming that it has, and I assume that it has—that has been put out by JFD has any bearing on the unfair competition aspect or the infringement aspect.

From the standpoint of infringement, I would assume—I am not assuming anything, I am asserting—that the best evidence with respect to infringement is the infringing devices themselves because as a matter of practice quite frequently advertisements don't spell out the full details of commercial antennas.

Secondly, from the standpoint of the unfair competition, I see nothing in the article itself which bears on unfairly competing with Blonder-Tongue. That is, on behalf of the University of Illinois. I see no reason that this shows any relevancy or any pertinency with respect to unfair competition as alleged that the University of Illinois Foundation was guilty of.

Mr. Cass: Your Honor, on behalf of JFD, I [806] object to the admission of this document as having any bearing or any relevancy on the question of infringement.

The patent in suit, D.26, issued July 5, 1966, any act of infringement must have occurred after the date of this patent.

The document that is offered in evidence, D.35, is identified as a document that this witness saw in 1963. On that question, therefore, of infringement, it has absolutely no bearing at this particular stage.

As far as the unfair competition is concerned, I submit that it has no relevancy and bearing on that point because this witness has testified that Blonder-Tongue did not get into the business of selling of antennas until October of 1963. It is not indicated where this exhibit has any bearing on the question of unfair competition as far as the business activities of this defendant, who was not in business on the antennas.

Mr. Rines: May I answer that, your Honor.

The Court: You may.

Mr. Rines: Paragraph 6 of the counterclaim for [807] unfair competition, which is also incorporated in the antitrust counterclaim, alleges that, in paragraph a: "Publication of copious advertisements in national, technical, popular publications, and elsewhere, circulated throughout the United States, including the Northern District of Illinois, using the names of both the said Foundation and JFD, knowingly and falsely representing the scope of their patent," and in paragraph b, conspiring to use the name and prestige of the Foundation in falsely representing—" and I am hitting the important thing—"sales catalogs and magazine advertisements throughout the country," and in paragraph c, "conspiring to join forces in a nationwide advertising campaign and otherwise misusing the name of the University in restraint of competition by false and misleading statements and by falsely libeling and disparaging competitors' businesses and antennas."

The comments, your Honor, contained in this admitted literature of JFD, if your Honor will notice, on the very second page, contains the picture of Mr. Mayes, the name of the University of [808] Illinois, and throughout this

document talks about the relationship of the University of Illinois, the Foundation, JFD, all of which are very germane, which, in addition, your Honor, contains information, particularly on page 5, as to the operation of the antenna. The title of the page is, "Why the LPV PV makes all other antennas obsolete." Then if you notice, your Honor, at the bottom of that page there are some figures given. Our proffer of proof, your Honor, is that those figures are false in conformance with our pleading in the counterclaim, that false advertising and false claims have been permeated throughout the—

The Court: Where are the allegedly false figures?

Mr. Rines: The curves, your Honor, at the bottom of—

The Court: By "figures," you mean drawings?

Mr. Rines: No, your Honor, these give numerical values—the graphs. Yes, your Honor; the graphs on the bottom of page 5 give numerical values showing what they call the actual gain curves.

[809] The Court: What you handed up to me has no paging, so I can't tell.

Mr. Rines: The page, your Honor, entitled "Why the LPV," the upper left-hand corner.

The Court: Yes, I have that.

Mr. Rines: Your Honor, the last graph at the bottom shows some numbers, and to the right it says that these are the actual gain curves.

Your Honor, we maintain that is absolutely false, and as part of our charge of unfair competition, we have called upon the defendant, JFD, for example, to produce those gain curves; they have never been produced, and we have a witness here who measured the LPV, that is what our testimony will show, 11, and can state that this is false, and that is the gravamen, one of the serious charges in this case of what they were doing to customers in the trade under the name of the University which hampered the operations of Blonder-Tongue and other competitors.

[810] The Court: Have you finished?

Mr. Rines: Yes, your Honor.

The Court: Mr. Cass?

This is your client's document. Will you reply to the remarks of Mr. Rines, more specially his suggestions about false statements contained in this proffered exhibit, Defendant's Exhibit 35 for identification.

Mr. Cass: We are not of the opinion that these statements can be characterized as Mr. Rines has done in his argument to the Court. This will be brought out later in our testimony in our case.

However, Mr. Rines has not replied to the objection to the admission of this document as having any bearing on infringement which he had originally stated to this Court, and so I presume that he withdraws from that position.

Mr. Rines: Yes, I do, Mr. Cass. I am sorry if I included infringement; I meant unfair competition.

The Court: This is wholly on the unfair competition aspect of the case?

Mr. Rines: And antitrust, your Honor.

[811] Mr. Cass: Your Honor, we cannot deny that this is an advertisement of JFD and as such it is a physical genuine exhibit. Still he has not replied to the question of relevancy of this document insofar as this witness' statement which would not substantiate the fact that this company was in business involving antennas of the type that are referred to in the exhibit at the time that he saw them.

The Court: Do you wish to add anything?

Mr. Marshall: Yes, I do, your Honor.

Mr. Rines in his remarks indicated that this reflects a relationship between JFD and the University of Illinois Foundation as well as the University of Illinois. Now I am sure your Honor is fully aware that the University of Illinois is not involved in this litigation. From the

standpoint merely of this document relating to any relationship between the University of Illinois Foundation and JFD, this obviously is not the best evidence. If Mr. Rines is interested in characterizing those portions of the document which he feels represent false and misleading [812] advertising, I would feel that perhaps that is relevant, but just to offer the document per se and say "Here, you find out where are the relevant things and the irrelevant things in here." I think that is too much of a burden to place upon the Court as well as counsel.

The Court: The objection of the plaintiff and counterclaim defendant will be ssutained to Defendant's Exhibit 35 for identification.

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[814] By Mr. Rines:

Q. Mr. Blonder, I hand you a two-page document marked for purposes of identification as Defendant's Exhibit No. 32 and I ask you if you can identify the same.

A. Yes.

Q. What is it, if you know?

A. It is an advertisement of JFD labeled "At the Moment of Truth."

Q. Do you know when you first saw this advertisement?

A. In late '63.

Q. Was your company at that time marketing antennas, log-periodic antennas?

A. Yes.

Mr. Rines: I would offer into evidence Defendant's [815] Exhibit 32.

Mr. Marshall: Same objection as we raised before, your Honor. I feel that the record would be burdened by merely repeating them.

Mr. Rines: May I be heard on that, your Honor.

The Court: Let's hear all of the objections, if there are any other objections.

Mr. Cass: On behalf of JFD I object on the same ground as Mr. Marshall has objected.

The Court: Certainly you may be heard, Mr. Rines.

Mr. Rines: Thank you.

The witness has identified that this document was out at the time his company was in the antenna business. The counterclaim for unfair competition alleges that as a result of the literature circulated while this defendant was trying—while Blonder-Tongue was trying to sell its antennas to Blonder-Tongue customers, that as a result of the misstatements in literature that was submitted to the trade, that Blonder-Tongue was damaged, and, your Honor, I feel that this exhibit constituting the statements of JFD in its circulars at that time is therefore admissible.

The Court: The reaction I get here is that [816] nobody has pointed out falseness here or unfairness. This is a piece of advertising. It says frankly that the device is licensed under one or more of certain United States patents and an additional patent, produced by JFD under a license from the plaintiff. Now what is there about that that stamps it as being false and fraudulent and unfair?

Mr. Rines: Your Honor will look, please, at the second page, the bottom paragraph, which is entitled "Higher Front to Back Ratios." There the statement appears "The LPV 11 maintains a front to back ratio of 35 DB on each VHF channel."

So your Honor will understand, that 35 DB, the testimony will show, is a measure of how good is this antenna. In this particular case Mr. Blonder would testify to his personal tests to show that it came nowhere near 35 DB, that this was a false claim, and Dr. Mayes in his deposition in this cause admitted this was false, your Honor.

Mr. Cass: May I make a statement on that on behalf of JFD?

The Court: Yes.

Mr. Cass: As I understand Mr. Rines' counter-

claim, he is saying that certain things happened to [817] Blonder-Tongue as a result of this particular advertisement. Whatever happened to Blonder-Tongue as a result of that advertisement is not properly proven by what this witness thought or believed that advertisement said but what customers or actual people in the trade reacted to in that ad, and therefore in the manner in which Mr. Rines proposes to produce this document, it has absolutely no bearing or no relevancy to this particular lawsuit.

The Court: You may reply.

Mr. Rines: Your Honor, I believe I am entitled to show the falsity of statements by any witness that has knowledge of that. This particular witness we will show tested this very LPV 11 himself and is here to tell your Honor whether that result advertised to companies is false and how false. [818] The Court: How is that an issue in this patent case?

Mr. Rines: Not the patent side, your Honor.

The Court: But even in an unfair competition case.

Mr. Rines: We maintain. your Honor, that in an unfair competition case, one of the reasons we will show—

The Court: You are offering this exhibit quite apart from any patent issue.

Mr. Rines: Yes, your Honor.

The Court: Quite apart.

Mr. Rines: Yes, your Honor.

The Court: You concede that on the face of it, borrowing a word I saw used here in another exhibit, there is nothing deleterious or intrinsically bad in this advertising. Can I take it in just because of what the advertisement says?

Mr. Rines: If that is germane, your Honor. The unfair competition law we are relying on is that customers were dissuaded from purchasing Blonder-Tongue antennas by claims made on the JFD antennas that exceeded any possible antennas that were [819] possible and done under color of using the name of the University of Illinois or the Foundation in the advertisement.

The Court: This is the wrong witness you have here.

Mr. Rines: If your Honor please—

The Court: Where is the customer?

Mr. Rines: Two points of the customers were handed up. If your Honor will recall, I handed up a memorandum to you yesterday citing the law in the Seventh Circuit with regard to whether this witness would be allowed to testify as to what customers reported were the reasons they were not buying, mainly such reasons as, "This literature tells us yours is no good."

Now, this is admissible under the Seventh Circuit decision I gave you, not for the truth of that fact, your Honor, but to show the customer's state of mind which is very germane to the whole problem of whether there was restraint of competition and whether these customers did not buy because of the false advertising and claims of JFD.

Mr. Marshall: Your Honor, I would also like [820] to point out—

The Court: Have you read, Mr. Marshall, American Cooperative, et cetera, versus Anchor Serum Company and the other cases cited in Mr. Rines' memorandum on this point?

Mr. Marshall: I haven't seen Mr. Rine's memorandum, your Honor. I am familiar with the Anchor Serum case.

Mr. Rines: Excuse me. I handed you a copy yesterday.

The Court: Apparently from the quotation—I have not had the time to pull down the books, but if the cases say what they apparently say from this brief memorandum, this witness can testify as an exception to the hearsay rule that their customers were misled by certain sales practices.

Now, what have you got to say to that?

Mr. Marshall: I was going to say, your Honor, that so far as this advertisement is concerned, there is no disparagement or attempt at disparagement of any competitor. It is merely a recitation of properties or sales puffing, if you want to call [821] it that, that JFD put out in its

advertisements. I have never heard of sales puffing ever being considered, where there has not been a direct disparagement of any competitor, as being false and misleading type of advertising that has the malicious connotation that Mr. Rines attempts to put on it.

The Court: I am inclined to agree with you, but in the interests of giving full consideration to all the evidence, within reasonable limits, the defendant here, counterclaimant, may have, I will, over the objection of the parties, take into evidence Defendant's Exhibit 32 for identification as Defendant's Exhibit 32.

(Said document heretofore marked Defendant's Exhibit 32 for identification, was received in evidence.)

The Court: I might say, Mr. Marshall, I am not impressed with the exhibit. I think its probative value is subject to grave—at least my grave doubts, but we will take it in.

This is the original?

Mr. Rines: No, your Honor, that is a copy for you.

[822] The Court: All right. I will keep it here.

By Mr. Rines:

Q. Mr. Blonder, are you familiar with the LPV 11 antenna referred to on the second sheet of Defendant's Exhibit 32?

A. Yes.

Q. What is your familiarity with it?

A. I personally tested the antenna.

Q. Would you describe the test to his Honor?

A. Yes. We have a test range on the roof of our factory. This test range is one that I designed. It was constructed according to my instructions. When the antenna in question was placed on the range, I went up and personally checked the measurements—I did it myself—to see what the measurements were, and I did make measurements on the antenna.

Q. Did you measure the front to back ratio of the LFV 11 on any VHF channel?

A. Yes.

Q. What result did you get?

A. I found that—

Mr. Marshall: Your Honor, I object to that [823] question on the grounds that this is not the best evidence as to what the results are. The best evidence is the data themselves.

The Court: I sustain the objection.

By Mr. Rines:

Q. Were these tests recorded, Mr. Blonder?

A. No.

Q. Do you recall what the tests showed?

A. Yes.

Q. Will you tell his Honor what they showed?

A. The front to back ratio on Channel 2, which is usually the critical channel, the one I checked, was about 10 to 12db.

* * * * *

[867] A. We tested a LPV-11 and that was the identification on the carton and on the antenna.

Q. What other JFD antennas did you test?

A. We tested a variety of them.

Q. What other ones did you test?

A. Personally?

Q. Yes.

A. Most of the antennas, I checked one or two characteristics. There was an LPV VU12, I think an LPV CL—either a 700 or 500, I have forgotten which. It had five driven elements—four driven, one parasitic. I remember the configuration, not the number. And there was an LPV 4, I think.

There were several. I have forgotten them all.

Q. How many LPV-11's did you test?

A. One.

[868] Q. How many models of the other antennas that you refer to generally did you test?

A. I checked at least one characteristic on all of them.

Q. But you tested only one antenna of each model?

A. Yes.

Q. Do you know, Mr. Blonder, whether or not the JFD antenna LPV-11 model that you tested was defective or not?

A. Not by my inspection.

Q. How about the others? Do you know whether they were defective?

A. All of these antennas were purchased, they were not used, they were all inspected; to my knowledge all of the portions, all of the parts were there. As far as I know they were made as the manufacturer intended them to be made.

Q. Could they have been defective?

A. I think it is possible for any product to be defective.

• • • • •

Q. I would like to get into another area with respect to count 2, based upon its broadside thrust at us.

[990] It is my understanding that defendant alleges a conspiracy of some kind between JFD and the University of Illinois Foundation—

The Court: There is more than an understanding. I have the allegations before me in the pleadings.

Mr. Cass: Then I would repeat my question as follows:

By Mr. Cass:

Q. It is my understanding that Blonder-Tongue alleges a conspiracy between the University of Illinois Foundation and JFD which resulted in acts violating the anti-trust laws of the United States, is that correct?

A. Yes.

Q. Is there any contract to which you can refer which substantiates such an agreement or conspiracy between these parties?

A. To my knowledge there is a patent agreement between them.

Q. Can you elaborate further to the Court as to what you have reference?

A. I don't have the agreement in front of me. I know that there is a contractual—or I have heard that there is a contractual agreement be- [991] tween the Foundation and JFD.

Q. And it is on the basis of what you heard that you filed a counterclaim against the University of Illinois and JFD alleging violation of the antitrust laws on the basis of a conspiracy?

A. I believe that in discovery—whatever that means—we found such an agreement, and it was presented in the claim.

Q. Is there such an agreement that has been introduced into evidence?

A. I think there must be. I haven't read all the papers.

Mr. Cass: I submit to the Court that I find no such agreement submitted in evidence.

The Court: Well, this isn't the time to argue it. If it appears later that the counterclaim hasn't been sustained, the Court will deal appropriately with it. I think it is proper to interrogate the president of this company which makes these very serious charges of conspiracy, and I am interested in knowing from this president of the company what caused him to make those allegations in the pleading filed in the United States District Court for the Northern District of Illinois. I [922] want to know, and I would be interested to know from this witness. If the allegations are true, those parties are exposed to treble damage suit on the claims here which could run into substantial sums of money. I have a great responsibility here.

So you may continue your examination.

Mr. Cass: Yes.

By Mr. Cass:

Q. Now, Mr. Blonder, do you know whether or not the so-called patent agreement that you have referred to is a written document?

A. I recall seeing the document.

Q. You recall seeing the document.

A. Yes.

Q. Is there any other agreement you allege between JFD and the University of Illinois Foundation which you believe supports your allegation of conspiracy by these two parties to violate the antitrust laws?

A. I saw letters that were exchanged from the Foundation to JFD which might be considered contractual.

Q. And these are additional items to which you are referring.

[993] A. Yes.

Q. Is it your position, by virtue of these so-called agreements and documents. is it the position of Blonder-Tongue that the University of Illinois Foundation is engaged with JFD in marketing and selling log-periodic antennas?

A. I'd say yes.

Q. You say yes.

A. Yes.

Q. Is it your position that the University of Illinois Foundation participates in the decision of models of antennas that are manufactured by JFD?

A. I have no knowledge of that.

Q. You have no knowledge. Do you have any knowledge as to whether the University of Illinois Foundation dictates or has anything to do with the volume of production of JFD in antennas?

A. I don't know.

Q. Well, would you explain to the Court what you mean by your statement that you believe the University of Illinois participates with JFD in the manufacture of antennas?

A. I didn't say that they manufactured antennas.

Q. Well, is it your position that they do [994] participate with JFD in the manufacture of antennas?

A. Not in manufacturing.

Q. No. Does the Foundation participate with JFD in the distribution of antennas?

A. No, not to my knowledge. I don't know.

[955] Q. Well, I am asking you on behalf of the defendant, sir. Does the defendant know of any such information?

A. No.

Q. Does the Foundation participate with JFD in any way with the pricing structure of JFD for antennas, if you know.

A. I don't know.

Q. You don't know?

A. No.

Q. Then I ask you, Mr. Blonder, in what way does the defendant allege or charge, if indeed it does, that the Foundation participated or participates with JFD in the marketing, manufacturing and selling of commercial antennas of the log-periodic type?

A. It is primarily in the selling area to which we have reference.

Q. Strictly in the selling area?

A. Yes.

Q. Is there any particular aspect of that selling area in which you charge the Foundation and JFD conspired to monopolize or violate the antitrust laws?

[996] A. Yes.

Q. Would you explain to the Court what that is.

A. The advertisements of JFD carry usually a reference to the fact that they are licensed under the patents of the University of Illinois Foundation, and as far as the advertisements of JFD and the literature, they are coupled together in terms of a relationship that is very strong. In fact, in the advertisements it usually states that JFD is the

exclusive licensee and no one else can manufacture antennas of the log-periodic type except JFD for commercial television use.

Secondly, our customers were visited by JFD representatives—

Mr. Cass: Now, your Honor, unless—I haven't asked this witness, and unless this witness can assure the Court that it was there at that time or there was some evidence to that effect, I move that the statement be stricken.

The Court: The answer is clearly not responsible. On your motion I strike it. Treating your remarks as a motion to strike, I will allow the motion.

Please read the question to the witness.

[997] (Question read.)

By the Witness:

A. I was told directly by a distributor that he could not buy the antennas because—I don't know how to answer it—because he was told by JFD he would be sued. That is why I am in this court today.

By Mr. Cass:

Q. Any other particular areas of that selling area?

The Court: He may answer that question and then I have a question I would like to ask.

You may answer that question.

Read the question to the witness.

(Question read.)

By the Witness:

A. I think I have answered it.

By Mr. Cass:

Q. The advertising—excuse me.

The Court: Mr. Witness, you said that is why you were in court today. You know, do you not, that you originally came into this court as as result of a suit filed by the University of Illinois Foundation and that thereafter you

appeared [998] here through lawyers and filed an answer, —that is, your company did, and a counterclaim.

Did you ever present a claim either to the University of Illinois Foundation or JFD Electronics Corporation prior to the pleadings you filed in this case which we are now trying asserting damages as a result of alleged violations of the antitrust laws of the United States?

The Witness: No, your Honor.

The Court: You never did, did you?

The Witness: We never did.

The Court: You may continue.

Oh, one other question.

In a document filed in your behalf here these words are used:

"Wherefore counterclaimant"—that is your company—"prays for relief and permanent injunction restraining the acts of unfair competition, antitrust violation and patent infringement complained of herein and for other relief."

Within your knowledge did any lawyer acting in your behalf ever apply to this Court for a preliminary injunction restraining any party to [999] this suit from violating the antitrust laws as such violation might affect your company?

The Witness: Not to my knowledge, your Honor.

The Court: You weren't very serious about having them restrained, then, were you?

The Witness: I was. I went on advice of counsel on the proper method to go about it.

The Court: You ask for a preliminary injunction in your pleading which I hold in my hand and which is signed by your counsel, but you never pursued that, did you?

The Witness: Our original intention was to secure relief as soon as possible. I think—

The Court: You didn't act on that intention?

The Witness: I asked to have it done. I must say I am not a lawyer. I just asked to secure—

The Court: We will take a brief recess, but before we do, it seems to me, without indicating any position whatsoever, after hearing the answers to some of the questions put to the witness by counsel and the Court, that the parties ought to sit down in this case and have an earnest talk about it. We know that these antitrust [1000] counterclaims are filed—shall I say routinely—in patent cases, certain patent cases, and I get a little weary of seeing prayers in counter complaints for preliminary injunction as a result of alleged violations of the Sherman Act not pursued at all. To me that has always smaked of a lack of diginity. It is true that the party itself—nobody acting for the party itself swore to the complaint in this case; it is signed only by counsel. But taking the pleading and taking the answers of this witness to questions in this area, it would seem to me that there ought to be a serious discussion about trying to resolve the party's difficulties in this case. I throw out to you that the question of this witness' credibility will have to be considered very, very seriously. Very serious charges of conspiracy are made in the original counterclaim and the amended pleading, and if I have heard it all in that area, while I express the thought I am not finding facts at this time, I leave it to counsel to try to guess what my finding might be in respect to those allegations claiming treble damages or triple damages, as the word is used in the [1001] pleading. I don't like those things if they are not substantiated.

* * * * *

[1003] Q. Mr. Blonder, can you name the manufacturers of commerical antennas in the United States other than JFD and Blonder-Tongue?

A. Yes.

Q. Would you name some of those?

A. Channelmaster, Finney—

Q. You have to—

A. Channelmaster.

[1004] Q. Is that the full name of that company?

A. Channelmaster Corporation.

Q. Where are they located?

A. Ellenville, New York.

Q. Would you continue?

A. Winegard Corporation.

Q. Where is that company located?

A. Burlington, Iowa.

Q. Any others?

A. The Finney Corporation.

Q. Where is that company located?

A. In Ohio. I am not such of the city.

Q. Any others?

A. The R-M-S Electronics, I believe in New York City.

Q. Would you spell that?

A. R-M-S, R dash M dash S, in New York City.

Q. Any others?

A. The RCA Service Company.

Q. Where is that company located?

A. Bedford, New York, I think.

Q. Any others?

A. Bedford, New Jersey, beg your pardon. [1005] Bedford, New Jersey.

Q. Any other manufacturers of commercial antennas?

A. The S & A Company. I am not sure where they are. I believe it is in the area of Iowa. Antennacraft, I believe also in Burlington, Iowa.

[1006] Q. Can you estimate for the Court how many manufacturers of antennas there are in the United States?

A. There are probably a dozen.

Q. Pardon?

A. There is probably a dozen manufacturers.

Q. Are you familiar with a company by the name of Jerrold?

A. Oh, yes.

Q. Do you know what their full name is?

A. Jerrold Corporation.

Q. Where are they located?

A. Philadelphia.

Q. How about GC Electronics?

A. I think they just went out of business.

Q. Do you know Kay Townes?

A. They are in Georgia.

Q. Do you know the full name of that company?

A. Kay Townes—I am not sure of the rest of it.

Q. Are you familiar with a company called Gavin?

A. Yes.

Q. Do you know what their full name is?

A. I think it was the Gavin Instrument [1007] Corporation. I don't know what it is today.

Q. Do you know where they are located?

A. Yes. They are in Somerville, New Jersey.

Q. Do these companies that you have named as well as others that you may have included in your number manufacture commercial antennas of the log-periodic type?

A. The majority do.

Q. Do any of these companies manufacture commercial television antennas of other types such as the Yagi and the bow-tie types, et cetera?

A. Yes.

Q. Now I have one more question to ask you: Did you supply the facts on which the various counts of the counterclaim were based to your attorney?

A. All the facts?

Q. I ask you again did you supply the facts on which the various counts of the counterclaim were based to your

The Court: Hand him the pleading and let him say which ones. They will be contained in the original counter-

claim because they are referred to [1008] but not repeated in the amended answer in the counterclaim.

Mr. Cass: Prior to asking the witness that particular question, your Honor—

The Court: Will you withdraw it for the moment?

Mr. Cass: I will withdraw that question for the moment.

The Court: You may put another.

By Mr. Cass:

Q. Mr. Blonder—

Mr. Cass: I do not wish to withdraw the question that I asked about supplying the facts; that I wish to stand. I am referring to asking the question that you had suggested.

The Court: All right. If he can answer the question without seeing the pleading, that will be all right with me. I was trying to expedite this matter.

Mr. Cass: For the record I still would like the question that I asked, "Did you supply the facts on which the various counts of the counterclaim were based to your attorney" to stand and the witness' answer to stand.

The Court: Yes. We will let that stand. [1009] We will let the question and answer stand. I will withdraw my request to you to show him the pleading. I thought it would expedite the disposition of the question.

By Mr. Cass:

Q. Mr. Blonder, did you attend at a deposition on Monday, October 24, 1966, at the offices of Silverman & Cass at 105 West Adams Street at 2:00 p.m. and give testimony under oath?

A. I have given testimony under oath in the offices. I don't know the exact date, but it was in that year.

Mr. Cass: There is on file with the Court a deposition transcript taken of Mr. Blonder on that particular time.

The Court: Do you recall, sir, in order to move this along, giving the deposition at Mr. Cass' office? His firm is Silverman & Cass. And what is the office address?

Mr. Cass: Suite 1900, 105 West Adams Street, Chicago, Illinois, commencing at 2:00 p.m. on Monday, October 24, 1966.

The Witness: Yes, your Honor.

[1010] The Court: All right.

By Mr. Cass:

Q. Do you recall being asked at that time by Mr. Mann, Mr. Basil P. Mann, on behalf of the plaintiff the following question:

> "Did you supply the facts on which the various counts of the counterclaim were based to your attorney?"

Do you recall that question?

A. No, I don't.

Q. Do you recall the answer that you gave to that question?

A. Not at that time, no, I don't.

The Court: That is not the way to do it. Read the answer to him and ask whether he made that answer to the question.

By Mr. Cass:

Q. Did you make an answer to that question as follows:

> "Yes."

A. I don't remember it.

Mr. Cass: At this time, then, your Honor, I would like to read from that deposition if it [1011] is necessary.

The Court: At an appropriate time you may offer the deposition but I don't think we should interrupt the testi-

mony of this witness. Certainly you have a right to offer any part of the deposition or all of it.

By Mr. Cass:

Q. Do you have a copy of the answer and counterclaim that was filed by Blonder-Tongue in this case?

A. I have a copy in front of me. I believe my attorney handed it to me. It must be the one.

Q. Would you point out in that amended counterclaim which of the facts you gave to your attorney with respect to Count I for unfair competition?

A. Do you want me to read down Count I, paragraph one by one or just give you the specific count?

Q. I ask the question. You supply the answer as you think it applies.

Which facts did you supply to your attorney for that purpose?

A. I supplied under 5(a) many of the [1012] publications of the advertisements that were made and circulated throughout the United States. I supplied these advertisements from actually seeing them in magazines and removing them from the same and putting them into the suit.

Q. Mr. Blonder, I am at a loss to follow your answer because I do not find a Paragraph 5(a) in the counterclaim of Blonder-Tongue.

The Court: There is no such designation.

Mr. Cass: There is no such designation, your Honor.

The Court: Not in the original which is on file in the official file of the Court.

The Witness: I beg your pardon. I skipped a page. Two pages were held together and I picked them up.

Paragraph 5(a) actually should be 7(a).

By Mr. Cass:

Q. Your reference, then, is to Paragraph 7(a)?

A. 7(a), yes.

Q. Now would you repeat your answer with respect to that paragraph? What facts did you supply?

[1013] A. I saw these advertisements and removed them from the magazines and supplied them to my counsel, and also in 7(b), the same advertisements carried such information; 7(c) as well. 7(d) I reported to my counsel directly that I had been told by customers that they could not purchase from us because of the pending suits; that is, the suits that would be made against the customers if they purchased our antennas.

Q. Your reference in Paragraph 7(e) to copious advertisements in national, technical, and popular publications and elsewhere, would you identify—

A. I am sorry. Which are you reading?

Q. I am reading from Paragraph 7(e).

A. Page 8?

Q. Page 6.

A. It says page 8. This must be another—this is now 7(a).

The Court: 7(a) is on page—

The Witness: Six.

The Court: —6.

The Witness: That's right.

[1014] By the Witness:

A. Is that where you were reading from?

By Mr. Cass:

Q. That is where I was reading from.

A. I thought you said 7(e).

The Court: We now have it at 7(a), not what you thought, sir; not what you thought. I don't want any explanations of what you thought. If you don't hear, say you don't hear.

Now repeat your question to the witness.

By Mr. Cass:

Q. In paragraph 7(e) of the counterclaim, there is reference to publication of copious advertisements in national, technical, and popular publications and elsewhere circulated throughout the United States, including the Northern District, et cetera. What were the facts that you supplied with respect to such copious advertisements—

A. May I have that question read again?

Mr. Cass: 7(a), I am sorry. Reading from paragraph 7(a), I apologize.

By Mr. Cass:

Q. There is reference to publication of [1015] copious advertisements in national, technical, and popular publications and elsewhere. What were the facts that you supplied with respect to publication of copious advertisements, sir?

A. Well, "copious" is a large quantity of, and that is what I supplied.

The Court: He didn't ask you, sir, to define the word. Now you are a man with several degrees; you are president of a large company. You know what the question was. Now answer it, or I will have to deal appropriately with you. I am a little weary of your not answering questions.

Read the question to the witness.

(The question was read by the reporter.)

By the Witness:

A. The facts I supplied were the actual advertisements and the fact that they were in publications that had a large circulation.

By Mr. Cass:

Q. And how many of such advertisements did you supply?

A. I would say probably about a dozen.

Q. A dozen.

A. Yes.

[1016] Q. Were those advertisements that appeared in publications for the year 1963—if you know?

A. I am not sure about '63.

Q. How about for the year of 1964?

A. I am not sure about '64.

Q. '65, sir?

A. Also '65.

Q. '66?

A. '66 I am pretty certain—

Q. Pardon?

A. '66.

Q. '67?

A. I believe '67 as well.

Q. You supplied then twelve ads of JFD which covered the period 1963 through 1967, is that right, sir?

A. I testified there was around a dozen. It wouldn't be exactly twelve. I don't know how many.

Q. Do you have any idea, sir, what percentage that around a dozen advertisements was of the JFD advertisements for the years 1963 through 1967?

A. No.

Q. Well, let's go on to Paragraph 7(b). [1017] What facts did you supply to your attorney there?

A. These same advertisements carried these statements.

Q. Incidentally, sir, for the year 1963 and through 1967 were any of those advertisements of the University of Illinois Foundation?

A. No.

Q. What facts did you supply to your counsel, if any, to support the allegations of Paragraph 7(c) of the counterclaim?

A. These facts came from the same advertisements.

Q. From the advertisements only of JFD, is that right?

A. No, I would say in addition the comments of our customers that they were told these same facts.

Q. Were these comments that you had been present at when they were made?

A. No.

Q. What facts did you supply to your counsel to support the allegation that the Foundation had joined in what you call "a crass commercial activity dedicated to the restraint of competition by such [1018] false and misleading statements above set forth"?

A. They came from the advertisements.

[1019] Q. The advertisement of JFD?

A. Yes.

Q. Are there any other facts that you would care to tell us about that you supplied to your counsel other than the advertisements?

A. I have not supplied any others.

Q. Did any other officer of Blonder-Tongue supply such facts, if you know, sir?

A. I believe other facts of a similar nature were supplied by other officers of Blonder-Tongue.

Q. By whom?

A. I believe Harry Gilbert.

Q. Harry Gilbert. Who else?

A. Well, that's the only other officer.

Q. How about the person whose last name is Tongue whose name appears in the name of the defendant, did he supply any facts?

A. I don't know whether he did.

Q. What is his full name?

A. Ben H. Tongue, Ben Hapgood Tongue.

Mr. Cass: I have no further questions.

The Court: I have a question.

On September 1, 1966, your counsel [1020] here in Chicago in a document signed by them and reciting that the firm of Rines & Rines of Boston were of counsel filed a

document entitled "Answer In Counterclaim" consisting of fourteen pages with an exhibit attached. I hold it in my hand.

Was that document ever shown to you by the lawyers before—

The Witness: Yes, sir.

The Court: It was shown to you? You checked it, did you?

The Witness: Yes, your Honor.

The Court: And you say now that the allegations in this document are true and correct?

The Witness: Yes, your Honor.

The Court: Do you want to look at it? I am referring particularly to the counterclaim rather than the answer.

The Witness: I find one mistake here but other than that I agree with it. On Page 7(c) it says, "University of Illinois"; it should have read "University of Illinois Foundation."

• • • • •

Deposition of JEROME I. COHN:

[1039] *Examination by Mr. Berliner.*

Q. Will you state your name and address for the record, please?

A. Jerome I. Cohn, 7 Osage Road, Rockaway, New Jersey.

Q. Who is your employer and in what capacity are you employed?

A. Blonder-Tongue Laboratories, Inc. I am presently employed as Product Manager, Distributor Products.

Q. How long have you been Product Manager of Distributor Products?

[1040] A. Since August 1st of last year, 1966.

Q. Are TV and FM antennas included in Distributor Products?

A. Yes.

Q. What position did you hold prior to being Product Manager for Distributor Products?

A. I was Eastern Regional Sales Manager.

Q. Does that mean that you were in charge of sales in the eastern region for products including TV and FM antennas?

A. I was responsible for the sale of all Blonder-Tongue products in the eastern region which included antennas, master antennas, closed circuit television and all other distributor products.

• • • • •

[1043] Q. In your contact with Blonder-Tongue customers have any of them ever advised you that JFD threatened not to sell them antennas if they purchased Blonder-Tongue antennas?

A. I have no direct knowledge of any of the customers that I dealt with in the eastern region specifically telling me that JFD threatened to discontinue the sale of products to them.

• • • • •

[1044] Q. Do you know of any instances where JFD threatened not to ship antennas unless the customer also purchased additional equipment such as converters and amplifiers?

A. In the eastern region I know of no specific case that I could put my finger on today.

I do know that JFD usually tried to use what I personally call aggressive selling to package the entire antenna line with their amplifiers and other components.

Q. Do you know of any instance where a particular JFD antenna could not be purchased as a single item?

[1045] A. It was my understanding from customers that the low end antennas could not be purchased without across-the-board purchasing from JFD.

Q. Who were these customers that you just referred to?

A. I think this was generally all customers.

Q. Well, be specific as to one or two. Let us start off with one.

A. The name of a customer who could not buy one single antenna?

Q. Yes.

A. The customers usually bought JFD across-the-board if they were JFD customers.

If they were not JFD customers, they could not buy a single antenna as such without buying across-the-board. They couldn't buy a conical antenna by itself. This is what is considered a low end of the antenna line.

JFD's policy, I believe, was, because there was nothing in writing, that you could not buy conical or the very cheap antennas by themselves but you bought these because you were a broad base JFD customer.

[1046] The names specifically I would have to go back and give you a complete list of every JFD account in the territory. Jim Wessels, Arlington Electronics in Arlington, Virginia. He was a JFD account. But he bought across-the-board. He bought broad band antennas, conicals, V's, the whole bit.

Q. I am asking you to name a specific customer who tried to buy just an antenna from JFD and JFD refused to sell him.

A. Just a single line of antennas or just a single antenna?

Q. Start with a single line.

A. Offhand I can't name him.

Q. How about the single antenna?

A. You mean a customer who was refused the sale of a single antenna; I can't specifically name it.

* * * * *

Deposition of HARRY GILBERT:

[1048] Mr. Phillips: On Page 5, Examination by Mr. Berliner:

"Q. Mr. Gilbert, please state your full name and address for the record.

A. Harry Gilbert, 108 Wilshire Drive, Cranford, New Jersey.

Q. What is your occupation?

A. I am the General Manager of Blonder-Tongue Laboratories, Inc."

From Page 6:

"Q. Does Sales report to you?

A. Sales reports to me."

* * * * *

[1062] "Q. Do you know of any customers that Blonder-Tongue has lost because of the activities of JFD?

A. No.

Q. Do you have any specific instances where the good will of Blonder-Tongue has been impaired by the activities of JFD?

A. No."

* * * * *

"Q. Who are the major competitors of Blonder-Tongue in the TV and FM antenna field?

[1063] A. It would be Winegard, Channelmaster, JFD and Finney.

Q. Do you believe those four companies are the largest in the field?

A. Throw Taco in there and I believe we have them covered.

Q. From the information available to you have you made any determination as to which of the five companies you have named does the most business in the antenna field?

A. In relative spending I think I have a feel for it. I would be going by recollection.

Q. Would you try to recall which of the five you named was the largest?

A. I think I would put Channelmaster first."

• • • • •

[1086] *Colloquy.*

Mr. Cass: Your Honor, at this time as part of the orderly course of this trial there is still a ruling to be made with respect to Defendant's Exhibit 32. Your Honor will recall that an objection was lodged against the admission of this exhibit because it had no materiality until it was shown how this advertisement affected customers.

The Court: I do recall that. I have a note of it.

Mr. Cass: At that time counsel for [1087] the counterclaimant said that they would introduce or show how it was relevant in that regard. I submit at this time there had been no testimony.

The Court: May I see the exhibit, please.

(Defendant's Exhibit 32 handed to the Court.)

The Court: Would you comment, gentlemen of the defense side, on "At the Moment of Truth"?

Mr. Phillips: Your Honor, there is no direct connection —and by direct I mean direct—there is no showing of a direct connection between that specific exhibit and the reaction of customers. The position of the defendant is merely one part of an overall campaign of the counterclaim defendant JFD through advertising, news releases, threats to the customers to prevent the sale of antennas by the defendant Blonder-Tongue.

The Court: I make no finding, of course, at this time, but I have listened very attentively here and I think what you describe as threats, while they may have occurred, I wasn't there nor were you, but it seems to me that they exist as far as the writings are concerned here on the

pleadings and even there in a very general way. [1088] There is certainly nothing here to connect up—no testimony to support the admission of this document. I sustain the objection to Defendant's Exhibit 32 for identification.

(Defendant's Exhibit No. 32 was denied admission into evidence.)

• • • • •

[1170] JAMES COLVIN, a witness called by and on behalf of the counter-defendant University of Illinois Foundation, having been first duly sworn, was examined and testified as follows:

Direct Examination by Mr. Mann.

Q. Will you state your full name and address for the record, please, Mr. Colvin.

A. James Colvin, 810 Indiana Avenue, Urbana, Illinois.

Q. What is your occupation?

A. I am Executive Director of The University of Illinois Foundation.

Q. How long have you been Executive Director?

A. About ten years.

Q. What are your duties as Executive Director of the Foundation?

A. I am the chief paid officer of the [1171] Foundation and administer the policies under the direction of the Board of Directors and direct the staff of the Foundation.

Q. Do you have any duties in connection with the patent licensing activities of the Foundation?

A. I examine them on behalf of the Foundation.

Q. Anything else?

A. Would you repeat the question, please.

Q. Do you have any duties in connection with the patent licensing activities of the Foundation?

A. I beg your pardon. I get reports from the patent counsel as they have negotiated with licensees and then take these to the Board of Directors of the Foundation for approval or disapproval.

Q. Do you play any role yourself in the negotiations leading to a license?

A. Very little.

Q. Did you play any part in the negotiations which led to the license with JFD?

A. I was familiar with the negotiations as they went along but I didn't engage in them.

[1172] Q. Are you familiar with the provisions of the contract which was entered into with JFD in 1962?

A. In a general way, yes, sir.

Q. I show you a copy of a document which has been introduced into evidence as Defendant's Exhibit No. 44. Are you familiar with that document?

A. I am, yes.

Q. What is it?

A. This is the licensing agreement between JFD Electronics Corporation and the Foundation.

Q. Are you familiar with the provisions of that contract?

A. In the main, yes.

Q. Does the contract have any provision calling for review of advertisements by JFD?

A. Yes, it does.

Q. Can you point out in what part of the contract this provision exists?

A. There is a Paragraph 10 which deals with this subject.

Q. Paragraph 10 of the contract provides for [1173] submission of advertising by JFD for approval to the Foundation, does it not?

A. Yes, sir, it does.

Q. Was the material submitted to you for approval by JFD in accordance with the provisions of Paragraph 10?

A. In the early months of the agreement, no.

Q. What do you mean by the early months? Can you identify that a little more specifically?

A. If I can recall the dates, the contract, the licensing agreement was entered into in 1962 and I think that the serious submission of advertising matter began in perhaps early '64. It was about two years before we got prior review.

Q. Do you know whether JFD actually issued any advertisements which were not submitted to you for review?

A. Yes.

Q. How did you become aware of this?

A. These were sent to us by faculty people and alumni in a number of instances and got to my desk.

Q. After you became aware of this fact, what did you do?

[1174] A. I spoke to patent counsel about this and suggested that JFD be approached to submit advertising in advance.

Q. Was JFD approached?

A. And JFD was, yes, sir.

Q. Do you know about when?

A. It is hard to remember the date, but I think it was early in '64.

Q. Since that time to your knowledge has JFD submitted its ads to the Foundation for approval?

A. Yes, it has.

Q. Who has reviewed the ads that have been submitted on behalf of the Foundation?

A. I have.

Q. In reviewing these ads, what aspect of the ad do you consider?

A. I consider references to the University itself and to the Foundation.

Q. Do you seek any technical review of the technical accuracy of any statement made in the ad?

A. There are times when I send these, refer these to the people in the Electrical Engineering Department of the University, but I make no [1175] attempt myself to analyze the technical aspects of it; that I am not capable of doing.

Q. How do you convey your approval or disapproval of these ads to JFD?

A. I telephone them usually and then confirm it by writing.

Q. Mr. Colvin, I hand you a document which has been introduced in evidence in this case as Defendant's Exhibit 30 and I ask you if you can identify any of those documents as having been sent or received by you.

[1176] A. Yes, sir. I recall all of these.

Q. In what connection do you recall them?

A. Well, I have conferred with patent counsel about these and also with JFD Company.

Q. Did you send any of those letters?

A. I don't think so.

Q. Look through them carefully.

A. Yes. I see one here that I, myself, wrote.

Q. Would you identify that document, please, by a number beginning with the letter capital A on the front of the document.

A. Oh, I beg your pardon. A-00223.

Q. In what connection was that letter sent?

A. We were asked to approve certain statements in advance—certain specific statements but used—which were going to be used in various ads from time to time, and we were asked for purposes of time if we approved this

phraseology, these specific phrases, in advance, and some we did and some we did not.

Q. Do you know whether the contract with JFD, Defendant's Exhibit 44, provided for the payment of royalties by JFD to the Foundation?

[1177] A. Yes, sir; I do know. It did provide.

Q. Who received the royalties on behalf of the Foundation?

A. Well, they were sent to the Foundation office in Urbana where I work.

Q. Were they sent to you or to your attention?

A. Yes; yes, sir.

Q. Do you know when the earliest royalty payments were made by JFD?

A. They were made for the first quarter of 1963, to the best of my knowledge.

Q. Mr. Colvin, to your knowledge did JFD ever use phrases in their advertising which you had disapproved?

A. No, they did not.

• • • • •

[1225] Q. At the time the antenna of Exhibit JFD 13 was constructed did those skilled in the antenna art know that it was necessary to increase boom spacing of a twin boom log-periodic antenna structure, in order to increase its characteristic impedance?

A. Yes.

• • • • •

[1233] Q. Does the Blonder, et al., Patent, Defendant's 26, illustrate a wire form impedance matching transformer?

A. Fig. 2 of Defendant's Exhibit 26 shows a rod-like elements 20 and 20′, which could be described as an impedance matching transformer.

Q. Is such a transformer found in the illustration of Fig. 1 of Defendant's Exhibit 26?

A. No.

Q. Referring to the Winegard Patent, Exhibit JFD 3-E, does this patent illustrate a wire form [1234] impedance matching transformer?

A. The figures illustrate a transmission line transformer. The elements of the transformer are shown in Fig. 3, for example, as 35 and 36, these elements being described as "bars made from tubing," such description being found in Column 3, Lines 4 and 5.

These elements are described as being a matching transformer in the specific language of the question it is found in Column 3, beginning at Line 20.

> "The posts 32 and 33 and the bars 35 and 36 connected thereto are essentially a linear one-quarter wave matching transformer. The principles of such transformers are well known in the art and from the available knowledge, one skilled in the art can readily develop the particular size and spacing of components for a specific antenna. See for example, Pages 103-107 and 165-168 of the A. R. R. L. Antenna Book of the American Radio Relay League, Inc. (1954), the disclosure of which book is incorporated herein by reference."

Q. In Figs. 2 through 4 of Exhibit JFD 3-E, [1235] how was the impedance matching transformer maintained in position?

A. The one end of the wires of the impedance matching transformer are affixed to the ends of the driven dipole, and the antenna. There is a dielectric spacer which serves to separate the two conductors of the transformer, and also serves as a mount for the terminals to which a lead-in would be connected.

This dielectric spacer is affixed to the boom by means of a spring clip.

The dielectric spacer is referred to by No. 40 in the draw-

ing. The spring clip is referred to by No. 46, and the boom is identified by the No. 14.

Q. Where are the output terminals for the transformer?

A. They are located on the dielectric spacer No. 40.

Q. In JFD Exhibit 3-E do you find a strain relief means for a parallel wire transmission line?

• • • • •

A. Yes, the strain relief is mounted to the [1236] mast and is indicated with the No. 51 in Fig. 2.

Q. In Fig. 2 what reference numerals are applied in region of the terminals for the transformer?

A. In Fig. 2 the end of the transmission line, which is affixed to the terminals are designated by 50-A and 50-B.

Q. Referring to Exhibit JFD 3-A, what does this patent teach you in connection with boom spacing and input impedance of an antenna?

A. This patent shows an example of the twin boom antenna, in which the input impedance of the antenna is controlled by controlling the spacing between the booms.

The booms are also used to provide mechanical support for the dipole elements of the antenna.

A description of the manner in which the impedance is controlled by spacing of booms is found in Column 2, Lines 3 through 21 of the patent.

• • • • •

[1238] Q. Now, referring to Exhibit JFD 3-B, what does this patent teach you in connection with boom spacing and input impedance of the antenna?

A. This patent also describes an antenna in which two booms are used for a dual purpose. The booms are used to support the dipoles of the antenna and also to serve as a transmission line for connecting the dipoles electrically.

The patent indicates that the input impedance of the antenna can be controlled by changing the spacing between the booms.

The particular passage in the patent which describes this is found at Column 3, Lines 20 through 25.

• • • • •

[1239] Q. Now, referring to Exhibit JFD 3-D, what does that patent teach you in connection with boom spacing and input impedance of an antenna?

A. This patent employs two rigid conductors, which are spaced apart with insulator blocks for the purpose of forming a transmission line used to feed an antenna.

The members of the transmission line are labeled "10," the insulator blocks are denoted by "11" in Fig. 2 and Fig. 1 of the patent.

The patent discusses the method of changing the impedance of that transmission line, beginning on Column 1, Line 51, through Column 2, Line 16.

• • • • •

PAUL EUGENE MAYES, called as a witness by the counterclaim defendant, having been previously duly sworn, resumed the stand, was examined and testified further as follows:

• • • • •

Direct Examination by Mr. Berliner (Resumed).

[1242] Q. Professor Mayes, what does Technical Report 52, Exhibit JFD 10, teach you in connection with boom spacing and antenna input impedance?

A. Technical Report No. 52, Defendant's Exhibit No. JFD 10, in that exhibit there is a section which describes the variation in the input impedance of log-periodic dipole array antennas. It indicates the various parameters upon which the input impedance depends and presents some experimental and computed data with respect to the variation of the input impedance. In particular the graph on Page 88 of the Report which is entitled [1243] Fig. 41, input impedance R_o versus feeder impedance Z_o gives

the variation in calculated and experimental values of the main resistance level R_o which is indicative of the input impedance of the antenna and shows how it depends upon the variation in the feeder impedance which is indicated by the symbols Z_o.

Q. Do you know what experimental procedures were used to obtain the experimental data appearing in Fig. 41 on Page 88 of Exhibit JFD 10?

A. Yes.

Q. What were those procedures?

A. The antenna having the parameters which are given in that particular figure was constructed with a means for adjusting the spacing between the parallel booms which served as the feeder for the antenna. The input impedance was measured with the particular spacing and then the spacing between the booms was changed and the measurement was repeated in order to get several data points indicating the variation in the input impedance as a function of the separation between the booms.

Q. What does JFD Exhibit 10 teach you in connection with dipole array configuration?

[1244] A. A dipole array configuration is shown in Fig. 6 on Page 12 of Technical Report No. 52 which is Exhibit JFD 10. This dipole array configuration is one in which the dipole elements are contained in two parallel planes, one plane which is spaced vertically above the other plane.

Q. What does Exhibit JFD 10 teach you in connection with means for positioning the feeder lines for the dipoles?

A. Exhibit JFD 10 indicates that there are two longitudinal conductors which are used for the feeder lines and they are spaced vertically one above the other in a parallel relationship one to the other.

Q. What does Exhibit JFD 10 teach you in connection with means for energizing the feeder lines?

A. In Fig. 6 on Page 12 of Exhibit JFD 10 a coaxial cable is shown connecting to the end of the two booms

which are used as feeders. They are connected to the end on which the shortest dipole elements in the array are connected, the dipole elements varying in length from one end of the array to the other. There is a statement also with regard to the method of energizing [1245] the antenna, which statement appears in the middle of Page 18. I will read the statement.

> "The antenna may be energized from a balanced twin line connected at the junction of the feeder and the smallest element."

Q. What does Exhibit JFD 10 teach you in connection with means for mounting an antenna having a twin boom construction?

A. In the photograph which is shown on Page 16, Fig. 7, of a twin boom antenna of the log-periodic dipole array type, there is shown a mounting bracket at an extension of the twin boom feeder conductors of the antenna, that extension being from the end of the antenna in which the longest dipoles are located.

Q. Can you correlate Figs. 6 and 7 of Exhibit JFD 10?

A. Fig. 6 is a schematic representation, a line drawing of a log-periodic dipole array, and Fig. 7 is a photograph of an actual model of such an antenna which was constructed and tested in the laboratory.

Q. Does Fig. 6 include a means for mounting the antenna shown therein?

[1246] A. No specific method of mounting the antenna is shown in Fig. 6.

Q. Is the antenna mounting means of Fig. 7 suitable for the antenna of Fig. 6?

A. Yes.

Q. Now referring to Exhibit JFD 3-C, what does the patent of this exhibit teach you in connection with dipole constructions?

A. This patent teaches a method of constructing an

insulator for holding the halves of a dipole element. The configuration as shown in Fig. 4 is one in which the dipole halves are not in a co-linear arrangement but, rather, one-half of the dipole is spaced a vertical distance above the other half of the dipole with a certain inner portion of the dipoles overlapping.

Q. Please refer to Exhibit JFD 3-F. What does the patent of this exhibit teach you in connection with means for positioning a transmission line which is connected to an antenna?

A. In Fig. 3 of this patent several stand off insulators are illustrated for the purpose of positioning the twin leads which are used to energize the antennas indicated in the figure.

[1247] The patent in Column 4, Lines 36 to 43, indicates how these stand-off insulators are used and I read:

• • • • •

The purpose for using such stand-off insulators is indicated in Column 4, Lines 51 through 57 where it says:

• • • • •

Q. Referring to the Blonder et al. Patent, Defendant's Exhibit 26, what does this patent teach you with respect to dipole arrays?

[1248] A. This patent teaches a utilization of separate planes of dipole elements, one plane spaced parallel to and vertically positioned above the other plane, the dipole elements varying in length from one end of the array to the other, the dipoles being connected to and supported by a pair of longitudinal conductors which are spaced vertically apart.

Q. Do you find corresponding teachings from the prior art as it existed prior to 1963?

A. Yes.

Q. Please be specific.

A. The figure which was referred to in previous testimony in Technical Report No. 52 indicates the same con-

struction for a dipole array. That is Fig. 6 on Page 12 of Exhibit JFD 10.

Q. Is there any other prior art you know of?

A. Yes. The antenna which appears here in the courtroom.

Q. You refer to Exhibit JFD 8-D?

A. Yes.

Q. Is there any other prior art that contains those teachings?

A. The other antenna which appears in the [1249] courtroom.

Q. JFD 13?

A. JFD 13.

Q. What does Defendant's Exhibit 26 teach you with respect to means for electrically interconnecting dipole elements in a twin boom construction?

A. Defendant's Exhibit 26 shows two longitudinal conductors which are spaced apart a specific distance in the vertical plane to which all of the dipole elements are connected at their inner ends, the dipoles being spaced at successive points along these longitudinal conductors or booms. They are also used for the support of the dipoles.

Q. Do you find this corresponding teaching in the prior art?

A. Yes.

Q. Please be specific.

A. This teaching is found also in Fig. 6 on Page 12 of JFD Exhibit 10 and is found in the two antennas in the courtroom.

Q. Are you referring to Exhibits JFD 8-D and JFD 13?

A. Yes.

Q. What does Defendant's Exhibit 26 teach you [1250] in connection with means for maintaining booms spaced apart in a twin boom antenna?

A. Defendant's Exhibit 26 shows insulating spacers

which serve to separate the two booms or conductors, longitudinal conductors of the antenna.

Q. Do you find corresponding teachings in the prior art as it existed prior to 1963?

A. Yes.

Q. Please be specific.

A. Dielectric spacers for the purpose of separating the two booms of twin boom antennas are shown in Fig. 6, Page 12, Technical Report No. 52, which is Exhibit JFD 10, and also in Exhibits JFD 8 and 13.

Q. I notice you were looking at Exhibit JFD 8-D.

A. This is the antenna which is present in the courtroom, yes.

Q. Is that the prior art you were referring to in your last answer?

A. Yes.

In this case the dielectric spacers are made of wood.

[1251] Q. What does Defendant's Exhibit 26 teach you in connection with the space in between parallel booms?

A. Defendant's Exhibit 26 teaches that the vertical separation distance between the twin booms be less than the average distance between successive dipole elements and each less than the wavelength of the band of operation.

Q. Do you find this corresponding teaching in the prior art as it existed prior to 1963?

A. Yes.

Q. Please be specific.

A. Such separations are indicated in Technical Report No. 52 which is JFD Exhibit 10 and also are present in the antenna models which are in the courtroom, JFD Exhibit 8-D and JFD Exhibit 13.

Q. What does Defendant's Exhibit 26 teach you with respect to the mounting of a two boom antenna to a mast?

A. Defendant's Exhibit 26 teaches a mounting which is at the end of the antenna on which the longest dipoles are located and in Fig. 1 is shown as an extension of the boom

support structure [1252] for the dipole elements which is then extended in a diverging manner and connected to a mast with straps.

Q. Do you find this corresponding teaching in the prior art?

A. The teaching of a mounting at the end of the array on which the largest or longest dipoles are located by means of a metallic plate which is connected to an extension of the booms is shown in Fig. 7 of Exhibit JFD 10. The specific wire form for mounting the structure to a mast is not shown in the prior art.

Q. What does Defendant's Exhibit 26 teach you with respect to securing a transmission line to a twin boom antenna?

A. Defendant's Exhibit 26 shows a guide which is provided as an extension of one of the—as a matter of fact, of both of the dielectric spacers which serve to hold the booms apart. The twin lead transmission line is inserted in this guide for the purpose of supporting the line.

Q. Do you find a corresponding teaching in the prior art as it existed prior to 1963?

A. I do not find this particular mechanical [1253] combination of a dielectric spacer with an integral guideline for supporting the twin lead.

Q. Do you find means in the prior art that function in the same way as an integral strain relief and insulating means for separating the terminals for connecting a parallel wire transmission line to an antenna?

A. Yes.

Q. Please be specific.

A. The strain relief members which were identified in connection with the Zip antenna previously, a drawing of which has been identified as Counter-Defendant's Exhibit No. JFD 5-B is one such member which could be used for the purpose of securing the transmission line in the vicinity

of the takeoff terminals of an antenna. Another such means is the strain relief which is depicted in Counter-Defendant's Exhibit No. JFD 20-A. Another such means is the Channel Master line lock which was previously identified. I do not have a copy of the exhibit before me from which to indicate the number.

Q. Are you referring to Exhibit JFD 4-A and 4-B?

[1254] A. Yes.

Q. Do those exhibits show an insulating means for maintaining twin lead connecting terminals in spaced apart relationship?

• • • • •

A. Yes.

• • • • •

[1255] Q. What is the purpose of the strain relief portion 2′ in the antenna shown in Fig. 1 of Defendant's Exhibit 26?

A. The strain relief portion 2′ of Defendant's Exhibit 26 is for the purpose of guiding the twin lead as it leaves the terminals of the antenna and taking the strain off of the connection between the antenna terminals and the twin lead.

Q. Did prior art strain relief members also perform both of these functions?

A. Yes.

[1256] Q. Does Defendant's Exhibit 26 teach the construction of a dipole array for operation over a predetermined frequency band?

A. No.

Q. Why not?

A. There is no specific indication about the relationship between the lengths of the dipoles and the frequency band to be covered, nor does it indicate how the lengths of the dipoles are to be varied, nor how they are to be connected to the transmission line as to say at what points along the

line they are to be connected.

Q. Is the antenna shown in Fig. 1 of Defendant's Exhibit 26 a log-periodic antenna?

A. There is not sufficient information given to determine whether or not it is a log-periodic antenna.

Q. What additional information would be necessary to make this determination?

A. The lengths of the elements, the locations of the connections between the elements and the transmission line.

Q. Please explain the expression "in the order of" as used in scientific engineering circles.

[1257] A. The phrase "in the order of" is ordinarily used to indicate the relative magnitude of figures. The expression indicates that the figures which are being compared would be of the same exponent when expressed as a power of 10.

Q. Please give the Court an example of the definition you have just given.

A. For example, a number being of the order of 5 would mean that it is somewhere between 1 and 10, approximately.

Q. Do you have an opinion as to whether or not it would have been obvious to one skilled in the antenna art prior to 1963 to add a strain relief member such as Exhibit JFD 5-C or the line lock of Exhibit JFD 4-A or JFD 4-B to either of the antennas of Exhibits JFD 13 and 8-D to support a parallel wire transmission line connected to the front end of these respective antennas?

A. Yes.

Q. What is that opinion?

A. It would have been obvious.

Q. Do you have an opinion as to whether or not it would have been obvious to one skilled in [1258] the antenna art prior to 1963 to add a strain relief member such as Exhibit JFD 5-C or the line lock shown in Exhibits JFD 4-A and 4-B to the antenna shown in Fig. 6 of Technical

Report 52, Exhibit JFD 10, to supoprt a parallel wire transmission line connected to the front ends of these respective antennas?

A. Yes.

Q. What is that opinion?

A. It would have been obvious.

Q. Why would it have been obvious?

A. This would have been a mechanical arrangement in which there is a high degree of predictability. The addition of a mere mechanical member to the antenna would have been well known and well recognized prior to the time of this invention as shown in Defendant's Exhibit 26.

Q. Did you play any part in the making of the chart marked as Exhibit JFD 14?

A. Yes, I did.

Q. What part did you play?

A. I conferred with the attorney in the preparation of this chart, suggesting some of the references which are given here.

[1259] Q. Have you examined the chart, Exhibit JFD 14?

A. Yes, I have.

Q. Do you agree with the opinion expressed at the lower right-hand portion of the chart, Exhibit JFD 14?

A. Yes, I do.

Q. Do you believe that all of the remaining contents of the chart, Exhibit JFD 14, are accurate?

A. Yes.

• • • • •

IN THE UNITED STATES DISTRICT COURT.

(Title Omitted in Printing)

STIPULATION.

It is stipulated by counsel for the University of Illinois Foundation and Blonder-Tongue Laboratories, Inc. that the following testimony and exhibits from other actions involving Isbell patent 3,210,767, or the application on which it issued, may be used herein with the same force and effect as if the testimony had been given in this action, subject to objections of relevancy and materiality:

1. The testimony of Marjorie Johnson given at the trial of *University of Illinois Foundation* v. *Winegard Company,* USDC SD Iowa, Civil No. 3-695-D, in February, 1967, and reported at pages 194 through 243 of the transcript of testimony given at that trial, together with the exhibits which were discussed or identified by Miss Johnson.

2. The exhibits which were discussed or identified by Mr. Lawler in testimony given at the trial of *University of Illinois Foundation* v. *Winegard Company,* USDC SD Iowa, Civil No. 3-695-D, in February, 1967, and reported at pages 671 through 690 of the transcript.

3. The stipulation of facts designated PX-C which formed a part of a motion for summary judgment in *The Finney Company* v. *JFD Electronics Corporation and The University of Illinois Foundation,* USDC ND Illinois, 65 C 220 and 65 C 671 (Consl.) and the publications and other written documents to which the stipulation refers.

4. The exhibits which were discussed or identified in the deposition of Harold Lawler given in *Isbell* v. *Kravis et al.,* Patent Office Interference No. 92,150.

Copies of the testimony identified above are bound herein. Copies of the exhibits which may not otherwise be identified and introduced at the trial are bound in another volume.

Hofgren, Wegner, Allen, Stellman & McCord

By_____

Attorneys for Defendant

_____, 1968

Merriam, Marshall, Shapiro & Klose

By_____

Attorneys for Plaintiff

_____, 1968

Excerpts from testimony of MARJORIE JOHNSON:

* * * * *

Direct Examination by Mr. Kulie.

[202] Q. Do you recall whether in April of 1959, Miss Johnson, the Engineering Research Laboratory of the University had a local library?

A. Yes, it did.

Q. Was this library and the materials in it available generally to the public?

A. Well, yes and no. The library itself was open, but some of the materials were kept locked in file cabinets, and the keys were only obtainable by having someone come to my office to have either me or one of my girls open the file cabinets to give them material that they had requested.

Q. What was the purpose of placing these reports or materials in locked cabinets?

A. Because the library was not staffed, and it was physically accessible to anyone, and for any purposes of control whatsoever, it was necessary to lock those materials up.

Q. The purpose then was not to restrict access to these materials?

A. No, it was primarily just to keep them.

Q. To stop somebody from lifting them off the shelves?

A. That's right.

Q. Who was responsible for this library, as librarian?

[203] A. Well, at that particular time, I think I was probably the librarian.

Q. You performed the function of librarian?

A. I kept the keys.

Q. And you performed the function of librarian for that local library?

A. Yes.

Q. Can you tell me where this library was located with respect to your publications office?

A. It was probably 200 to 300 feet down the hall, and on the same floor.

Q. And these publications which were kept locked for purposes of preventing lifting of the reports, these were in your office, is that what you testified to?

A. Now, which ones?

Q. The materials that you indicated were kept in the locked cabinets, were these in your office?

A. No, they were in the library.

Q. In the library?

A. In the library.

Q. Excuse me. I didn't understand. Were copies of technical reports generally available in this library to any user?

A. Yes, if they had the keys and someone would check them out to them.

[204] Q. Was there generally somebody available in your office or elsewhere to give these keys if somebody wanted a report?

A. During normal business hours, yes.

Q. Were reports of University research groups available in this library?

A. Yes.

Q. Reports from elsewhere in the country, generally?

A. Yes.

Q. Now, you testified earlier that when you received a publication or a report or other material for the local library—excuse me—would you tell me when you received a publication, report, or other material for this local library, when it would become available as a library reference?

A. As a specific library copy, it might not be available for a week or two after it had arrived from the printer. The problem always in a situation like that is that we had one of the girls who, when she didn't have anything else to do, would fill out library cards and mark documents, and so occasionally things would pile up for several weeks before we would get around to officially putting them into the library with a recorded library number and a library file card, so it is very difficult to say how long it would be before it would be officially available as a library copy.

Q. I perhaps characterized it improperly. What I meant [205] to say was when it would physically become available?

A. Physically, reports would be available from the office as soon as they were delivered from the print shop.

Q. By "from the office," you mean from the publications office?

A. Yes.

Q. And from you, as librarian of the local library?

A. Yes, and as Chief of the Publications Department.

Q. Was this true with respect to reports of the Antenna Laboratory?

A. Yes.

Q. Were reports that were received in your office displayed anywhere about the office?

A. We had a rack, a magazine-type rack that was just outside my office door, and just next to the mail boxes in the corridor, and copies of reports from our own laboratories as well as copies of reports from other laboratories would be displayed there in an array that we would change from time to time.

Q. Was there any indication on this rack regarding the availability of any report in your office?

A. To the best of my knowledge, I really don't know. I believe there was a little sign, a little hand-printed sign that said "Do Not Remove From This Rack," or "Copies May Be Checked Out In Publications Office," but it has been so long, [206] I'm not really sure.

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[213] Q. Now, I show you a copy of a report in a plastic ring binder which previously has been marked for identification as Defendant's Exhibit A-3(b), and ask you if you will identify that document?

A. This is the Antenna Laboratory Quarterly Engineering Report No. 2, Research Studies On Problems Related To ECM Antennas, issued under Contract No. AF6079.

• • • • •

[216] Q. With the extra copies of this material that you had printed, and I specifically refer to Quarterly Report No. 2, would it have been available in your office for distribution upon request on the date it was delivered in your office?

A. Yes.

Q. If I had come to your office on April 30th, the date indicated on that requisition document, and requested a copy of Report No. 2, would I have been likely to have been delivered a copy?

A. Very likely.

Q. Would you say then, Miss Johnson, that Quarterly Engineering Report No. 2 was available in your office on

April 30th, 1959 to the same extent as any other publication or report was available in your office either as a library reference or as an extra copy?

[217] A. To my knowledge, yes.

Q. So that, to this extent, you would not distinguish the availability of this Report No. 2 from any other similar report then in your office?

A. No.

• • • • •

[235] Q. Miss Johnson, you indicated under examination by Mr. Marshall that a Mr. Lawler was your supervisor, is that correct?

A. Yes.

Q. Was Mr. Lawler advised, or was he involved in any of the actual work of typing of these reports?

A. No.

Q. Was he involved in the printing or the arrangements for printing of any of these reports?

A. No.

Q. Was he involved in the distribution or arranging for distribution of any of these reports?

A. No.

Q. This was your responsibility?

A. Yes.

Q. With respect to Exhibit H-4, Miss Johnson, which is entitled "Local list", is this representative of a type of local list which from time to time you had available to you for distribution locally within the University?

A. Yes.

Q. And this related to distribution of copies of technical reports and progress reports?

A. Yes.

• • • • •

[240] Q. (By Mr. Kulie) Miss Johnson, were these re-

ports returned to you from the printer in any particular form?

A. They were simply packaged in brown paper, 10 to 20 to a package, depending on the size of the report.

Q. Were the covers and text delivered separately?

A. No, they were completely bound at the printers and returned to me as completed books.

Q. Now, Miss Johnson, having seen that document, H-11, I again ask you whether in your opinion quarterly engineering report No. 2 was available in your office on April 30, 1959 to the same extent as any other publication or report was available in your office, either as a library reference or as an extra copy?

A. In my opinion, yes.

• • • • •

[243] Q. Miss Johnson, whether these documents were in brown wrappers, on the desk, on a shelf, on the floor, were they available as a library reference on the date that they were received in your office?

A. Yes.

• • • • •

AF 33(616)-3079

Distribution Total 1357

LOCAL LIST 5338.

	Technical	Progress
P. Hayes	9	9
Dr. E. C. Jordan, E. E. Bldg.	1	1
Dean Wendell Miller, 145 E. E. Bldg.	1	1
Engineering Library, 103 Civil Eng. Hall	2	2
Local Library, E.E.R.L.	1	1
C. H. Tang (box)	1	1
Raj Mittra, E.E. College box	1	1

DX

PX-C

IN THE UNITED STATES DISTRICT COURT,
For the Northern District of Illinois,
Eastern Division.

The Finney Company, a partnership, *Plaintiff*, *vs.* JFD Electronics Corporation, a corporation, and The University of Illinois Foundation, a non-profit corporation, *Defendants.*	Civil Action Nos. 65 C 220 and 65 C 671 (Consl.)

STIPULATION OF FACTS.

It is hereby stipulated and agreed by and between the parties to this cause, by their undersigned counsel, that:

1. The contract between the University of Illinois and the Air Force, No. AF33(616)-6079 required the University of Illinois to distribute copies of Quarterly Reports and Technical Reports prepared under such contract to designated groups and individuals listed in a "Distribution List" established by the Air Force.

2. Copies of Quarterly Engineering Report No. 1, prepared by the University of Illinois under its said Air Force contract, were printed and distributed to the said Distribution List before April 1, 1959.

3. The said Quarterly Engineering Report No. 1 includes the following statement appearing on page 2:

> "*2.3 Plans for Next Interval*
> An investigation of log periodic structures of thin linear elements (zero tooth width) is planned."

4. Quarterly Engineering Report No. 2, prepared by the University of Illinois under its said contract with the Air Force, was printed and 148 copies thereof were delivered by the printer to Miss Marjorie Johnson, the acting Technical Editor of the Publications Office of the Electrical Engineering Department of the University of Illinois. Printing and binding of said copies was completed April 29, 1959, and said copies were at the office of Miss Marjorie Johnson at the University on April 30, 1959.

5. The said Quarterly Report No. 2 contains on pages 2 and 3, respectively, a written description and a schematic illustration of an antenna credited to Dwight E. Isbell, the same Dwight E. Isbell who was named the inventor in the patent in suit No. 3,210,767 granted on an application filed in the United States Patent Office on May 3, 1960 and assigned Serial No. 26,589.

6. The said schematic illustration illustrates an antenna having the same dipole length and spacing relationships as the antenna illustrated in Figure 1 of the said application and described in the related portions of the specification thereof.

7. The said schematic illustration illustrates the same crossover front feed that alternates in phase between successive dipoles as is illustrated and described in the said application.

8. The said written description and schematic illustration illustrate and describe an antenna having the same electrical structure, mode of operation, and performance as the antenna disclosed and claimed in the said application.

9. The said written description and schematic illustration provide a description which would be sufficient for anyone with antenna design experience to construct a successful antenna having a mode of operation and performance identical to the antenna disclosed in the said application.

10. The earliest distribution of any of the printed copies of the said Quarterly Report No. 2 to the groups and individuals on the said Distribution List occurred on May 5, 1959, when the addressed copies were deposited in a United States Post Office at Champaign, Illinois.

11. A printed copy of Technical Report No. 39, prepared by the said Dwight E. Isbell of the University of Illinois under the said Air Force contract was received by the Library of Congress on September 21, 1959, and was a "printed publication" as defined in Title 35, U. S. C., Section 102(b), as of that date.

12. Technical Report No. 52, prepared by Robert L. Carrel, of the University of Illinois, was received by the Defense Documentation Center for Scientific and Technical Information of the Department of Defense on October 18, 1961 and was a "printed publication" as defined in Title 35, U. S. C., Section 102(b) as of that date.

13. The Robert L. Carrel who authored the said Technical Report No. 52 is the same Robert L. Carrel who was named one of the joint inventors in the patents in suit Nos. Re. 25,740 and 3,150,367.

14. The printed publication CTR-198 of the Research and Development Division of Collins Radio Company, heretofore identified in this suit as Plaintiff's Exhibit 12 (PX-12), was a printed publication at least by May 14, 1958, when copies thereof were filed in the Copyright Office, Library of Congress with an application for registration of the copyright thereon.

15. A paper entitled "Some Recent Results in Frequency Independent Antenna Research," as printed by The 20th National Electronics Conference Seminar in a brochure entitled "Topics in Modern Antenna Theory," and bearing the date of October 19, 1964, was delivered by Paul E. Mayes, Associate Director of the Antenna Laboratory, Electrical Engineering Department, University

of Illinois, shortly prior to that date. Said Paul E. Mayes is one of the patentees of each of U. S. patents 3,150,376 and Re. 25,740 here in suit.

16. The book "Radio Engineers' Handbook," by Frederick Emmons Terman, First Edition, McGraw Hill Book Company, Inc., was published during the year 1943 as stated therein, and copies of selected portions thereof may be introduced by any of the parties and received in evidence subject to objection by any adverse party on any ground other than authenticity.

Respectfully submitted,

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Murray Hill 5-8470.

DEPOSITION OF EDWARD FINKEL TAKEN NOVEMBER 1, 1966.

• • • • •

[20] Q. Is it fair to say that you regarded your relationship with any of the University or University Foundation people, Professor Mayes and others, as something more intimate than just a bare license arrangement?

A. Absolutely not.

Q. You did not?

A. It was strictly licensing arrangement.

Q. Was this a fact that was known and well understood by you and the others at JFD from the very beginning of your relationship?

[21] A. Yes.

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